

BUEING

NUMBER

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CODE IDENT. NO. 77272

D210-11168-3-Volume 8 of 13

TITLE CH-46 COMPOSITE ROTOR BLADE FLIGHT

STRESS SURVEY DATA, PLOTTED FORWARD

LEVELTH 616

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PROFITED
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REV LTR

BOEING VERTOL COMPANY

P.O. BOX 16858
PHILADELPHIA, PENNSYLVANIA 19142

CODE IDENT. NO. 77272 D210-11168-3-Volume 8 of 13 NUMBER CH-46 COMPOSITE ROTOR BLADE FLIGHT TITLE STRESS SURVEY DATA, PLOTTED FORWARD VIII. AND AFT ROTOR SHAFT LOADS ORIGINAL RELEASE DATE_ . FOR THE RELEASE DATE OF SUBSEQUENT REVISIONS, SEE THE REVISION SHEET. FOR LIMITATIONS IMPOSED ON THE DISTRIBUTION AND USE OF INFORMATION CONTAINED IN THIS DOCUMENT, SEE THE LIMITATIONS SHEET. CONTRACT N00019-75-C-0396 MODEL ___ CH-46 ISSUED TO: ISSUE NO. PREPARED BY DATE /- 26-79 APPROVED BY Mardy DATE 12-1-78 APPROVED BY DATE 2-23.79 APPROVED BY

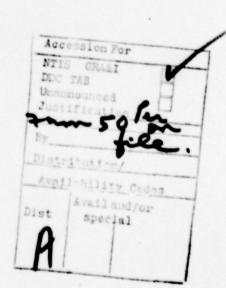
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FORM 44210 (9/73)

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LIMITATIONS



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All revisions to this document shall be approved by the above noted organization prior to release.

FORM 4411 17471

DESCRIPTION	DATE	APPROVAL

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PORM 40200 (7/07)



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FORM 46888 (7/07)

PREPARED BY:

CHECKED BY:

J. Bendo

D210-11168-3 NUMBER Vol. 8

THE BOEING COMPANY DATE:

8/28/78

REV LTR MODEL NO.

ABSTRACT

This report volume presents plotted forward and aft rotor shaft loads measured during the CH-46 Composite Rotor Blade Flight Stress Survey.

KEYWORDS

CH-46E Composite Rotor Blade Flight Stress Survey Alternating and Steady Loads



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* 10	Aft Shaft Bending, Lower (90° - 270°)	340
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	GW = 24300 lbs., C.G. = Aft (4.4" Fwd)	366
	GW = 24300 lbs., C.G. = 1.5" Aft (Ext. Cargo)	373

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8/29/78

REV LTR MODEL NO.

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4.5

REFERENCES

- Vertol Report D210-11168-1 "CH-46 Composite Rotor Blade Flight Test Qualification Test Plan" March 30, 1977
- Vertol Report D210-11168-2 "CH-46 Composite Rotor Blade Flight Test Report" May 15, 1978
- Boeing Vertol Report D210-11168-3 Volume 1 of 13, CH-46 Composite Rotor Blade Flight Stress Survey Data
- Boeing Vertol Report D210-11168-3 Volume 12 of 13, CH-46 Composite Rotor Blade Flight Stress Survey Data, Tabulated Forward and Aft Rotor Shaft Loads

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D210-11168-3 NUMBER Vol. 8

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1. INTRODUCTION

A flight stress survey was conducted on a CH-46 helicopter with A02R1702 composite rotor blades. The test was conducted in accordance with Paragraphs 4.3.2 and 4.7 of Reference 1. General test description and pilot comments are included in Reference 2.

The tests were conducted at the Boeing Vertol Flight Test Facility at Ridley Township, Pennsylvania, during the period of June 1977 through November 1977.

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SUMMARY

A flight stress survey and structural demonstration was conducted on the #1 CH-46E Helicopter, BuNo. 153372 (S/N 2268).

The components under test were the A02R1702 composite rotor blades and the A02R1710 blade socket.

This volume contains measured steady and alternating forward and aft rotor shaft loads plotted versus true airspeed. The same data is tabulated in Volume 12.

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DATA PRESENTATION

This report contains measured steady and alternating forward and aft rotor shaft loads. The data is presented as plots versus true airspeed. The steady and alternating values are plotted separately and appear together as two plots per page for various level flight and maneu ver conditions. The load levels shown represent the maximum alternating load cycle occurring during the particular flight condition. This same data is tabulated in Volume 12.

Detailed flight condition parameters and a complete tabulated summary of maneuvers for each flight can be found in Volume 1 of this report.

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Vol. 8 REV LTR

THE BOEING COMPANY

DATE:

8/31/78

3.1 Gage Identification and Index

Data plot indexing, strain gage identification and instrumentation code information for data presented in this volume are as follows:

DATA CODE	MEASUREMENT		
ACTIVE SPARE	NAME	UNITS	PLOT PAGE
41200 41210/ 61200	Forward Rotor Shaft Torque	(IN-LB)	21
41160 61160	Forward Shaft Bending, Upper (0°-180°)	(IN-LB)	58
41170 61170	Forward Shaft Bending, Upper (90°-270°)	(IN-LB)	92
41870 61870	Forward Shaft Bending, Lower (0°-180°)	(IN-LB)	126
41880 61880	Forward Shaft Bending, Lower (90°-270°)	(IN-LB)	160
49200 69200/ 69210	Aft Rotor Shaft Torque	(IN-LB)	194
49160 69160	Aft Shaft Bending, Upper (0°-180°)	(IN-LB)	230
49170 69170	Aft Shaft Bending, Upper (90°-270°)	(IN-LB)	264
49230 69230 ,/	Aft Shaft Bending, Lower (0°-180°)	(IN-LB)	306
49240 69240	Aft Shaft Bending, Lower (90°-270°)	(IN-LB)	340

NOTES: 1. A complete description of the instrumentation for this stress survey can be found in Volume 1.

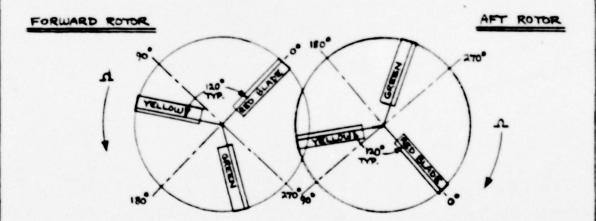
- 2. A flight by flight summary of operative gages can be found in Reference 2.
- 3. The spare gages were utilized when the active gages proved inoperable.

3.2 Sign Convention

The following table summarizes the sign convention adhered to for the gages presented in this volume.

In addition, a sketch (found below), presents a top view of the forward and aft rotor blades showing the angular orientation and positioning of each blade.

GAGE MEASUREMENT NAME	(+) POLARITY CONDITION
Forward Rotor Shaft Torque	Blade Lagging
Forward Shaft Bend., Upper (0°-180°)	Red Blade Down
Forward Shaft, Bend., Upper (90°-270°)	Yel. Blade Down
Forward Shaft Bend., Lower (0°-180°)	Red Blade Down
Forward Shaft Bend., Lower (90°-270°)	Yel. Blade Down
Aft Rotor Shaft Torque	Blade Lagging
Aft Shaft Bend., Upper (0°-180°)	Red Blade Down
Aft Shaft Bend., Upper (90°-270°)	Yel. Blade Down
Aft Shaft Bend., Lower (0°-180°)	Red Blade Down
Aft Shaft Bend., Lower (90°-270°)	Yel. Blade Down



TOP VIEW LOOKING DOWN

D210-11168-3

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3.3 Plot Format

The data plots have been grouped by common flight conditions and maneuvers and are presented in the order outlined by the data plot format table included on the next page.

For identification of data plots the plot code number in the right hand column of the table is printed on each corresponding plot chart.

Please note that many symbols are used more than once.

GROSS WEIGHT LBS.	C.G. IN.	HD FT.	RPM	CONDITION	PLOT CODE NO.
20800	22.4"Fwd	2000	264	Level Flt.	- 1
		14000		Level Flt.	- 2
		A11		Pullups (PWR ONSOFF), P.P.D. Rec.	-11
				Turns (PWR ON&OFF)	-15
				Control Rev.'s (PWR ON)	-19
				Control Rev.'s (PWR OFF), Flares	-23
	+	<u> </u>		P.P.D.'s, Autorotation	-27
	9.7"Aft	2000		Level Flt.	- 3
		6000		Level Flt.	- 4
		14000	1	Level Flt.	- 5
		6000	248	Level Flt.	-10
		All	264	Pullups (PWR ON&OFF), P.P.D. Rec.	-12
				Turns (PWR ON&OFF)	-16
				Control Rev.'s (PWR ON)	-20
				Control Rev.'s(PWR OFF), Spiral Desc., Flares	-24
<u>†</u>	7	1		P.P.D.'s Autorotation	-28
24300	13.2"Fwd	2000		Level Flt.	- 6
		8000		Level Flt.	- 7
		All		Pullups (PWR ONSOFF)	-13
				Turns (PWR ON&OFF)	-17
				Control Rev.'s (PWR ON)	-21
				Spiral Descent, Flares	-25
1	1	1	1	P.P.D.'s, P.P.D. Rec., Autorotation	-29

CONTINUED ON NEXT PAGE

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Plot Format (Continued)

GROSS WEIGHT LBS.	C.G. IN.	HD FT.	RPM	CONDITION	PLOT CODE NO.
24300 4.4"Fwd	4.4"Fwd	2000	264	Level Flt.	- 8
	8000	1	Level Flt.	- 9	
		All		Pullups (PWR ON&OFF)	-14
				Turns (PWR ON&OFF)	-18
				Control Rev.'s (PWR ON)	-22
				Spiral Descent, Flares	-26
	+	+		P.P.D.'s, Autorotation	-30
+	1.5"Aft	2000	+	Level Flight (External Cargo)	-35

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4. PLOTTED DATA

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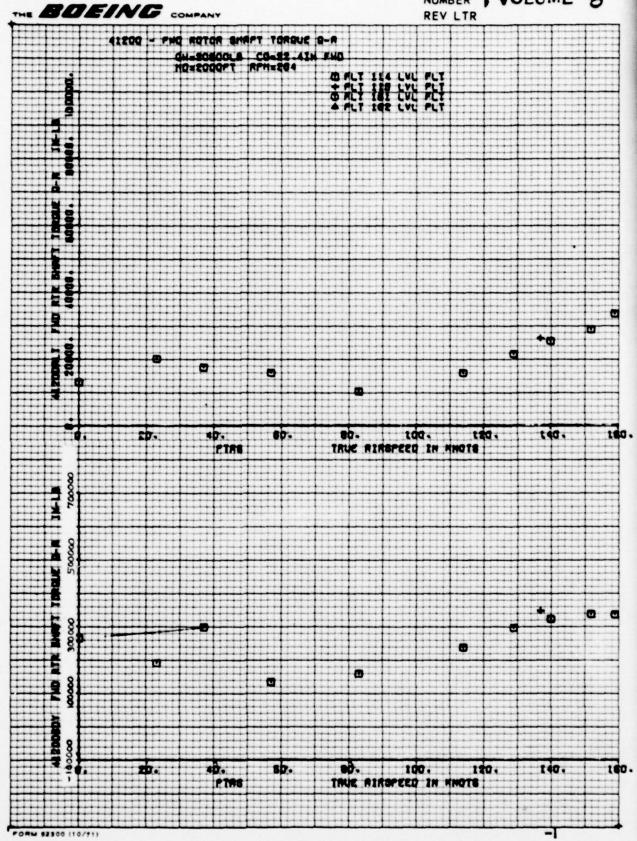
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THE BUEING COMPANY DATE:

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8/28/78

MODEL NO. 4.1 Forward Rotor Shaft Torque



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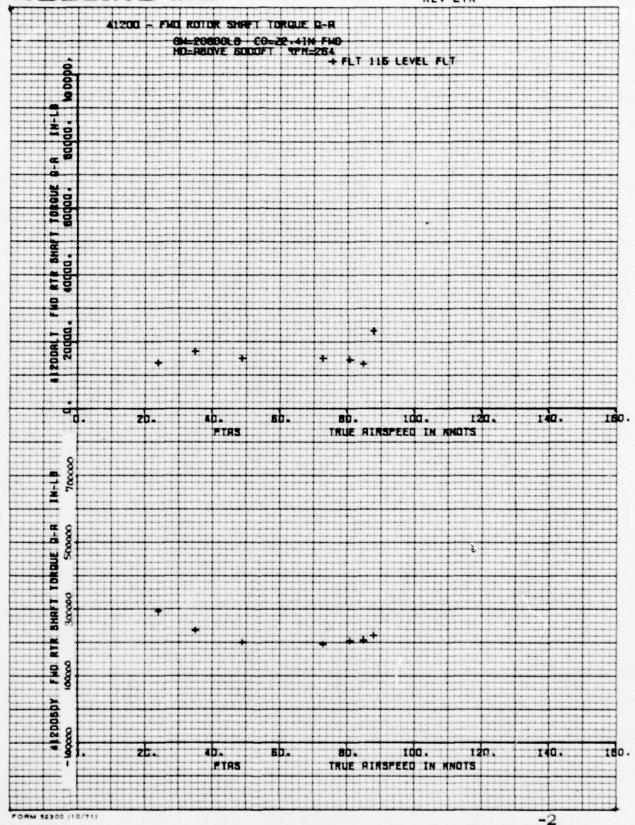
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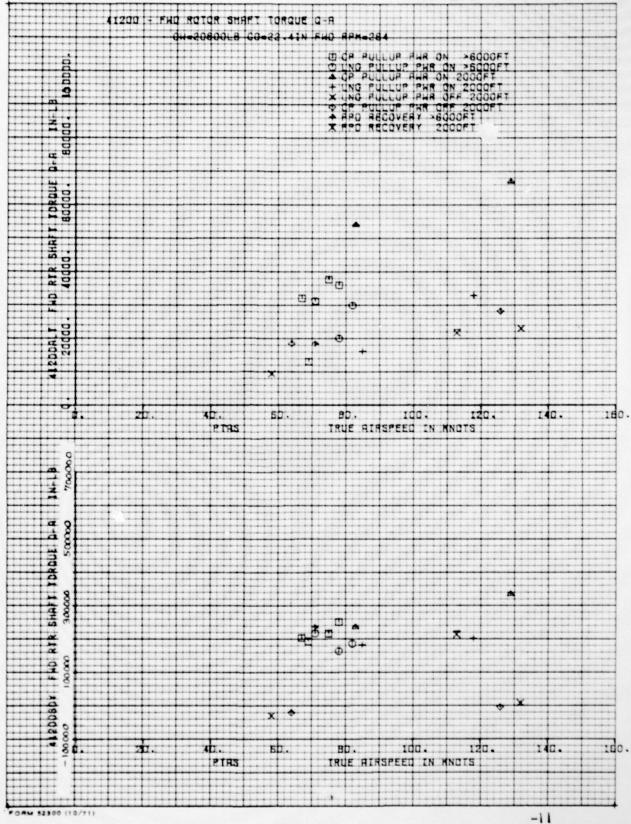
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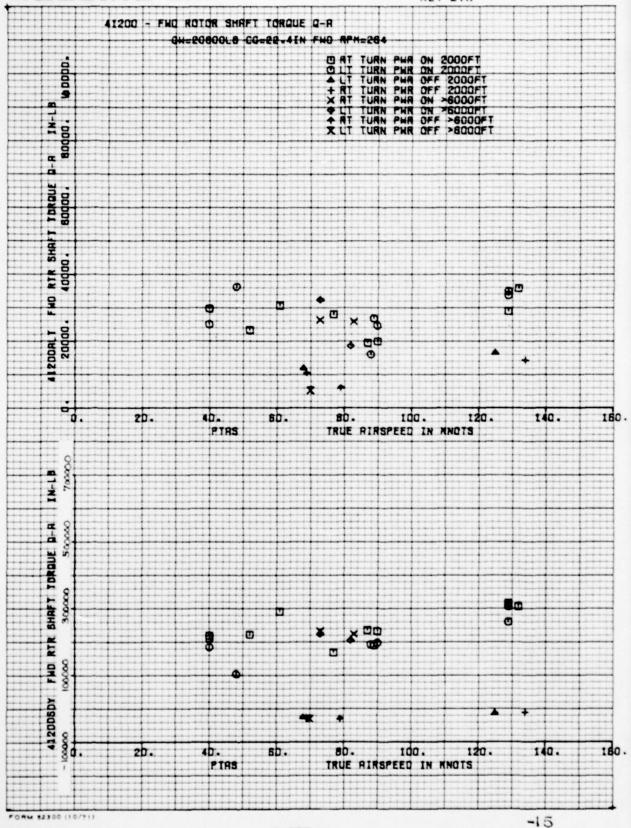
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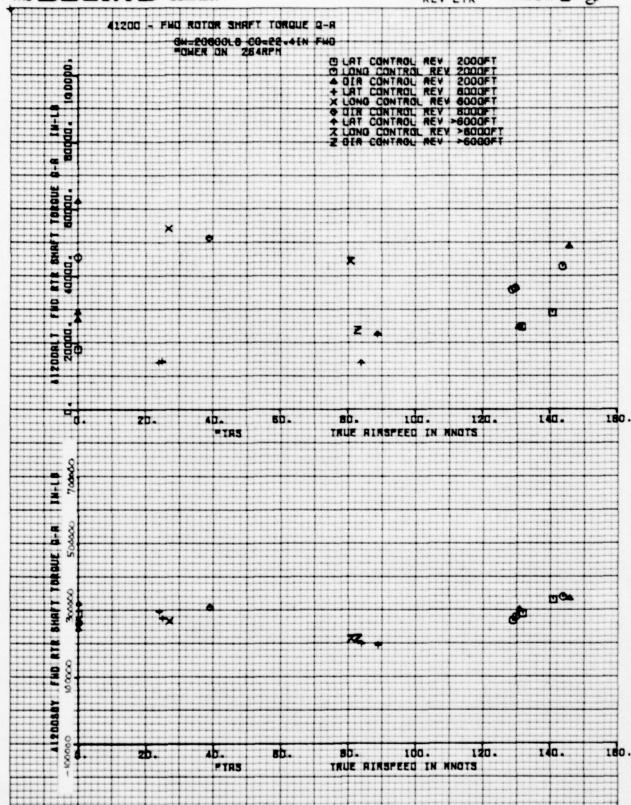


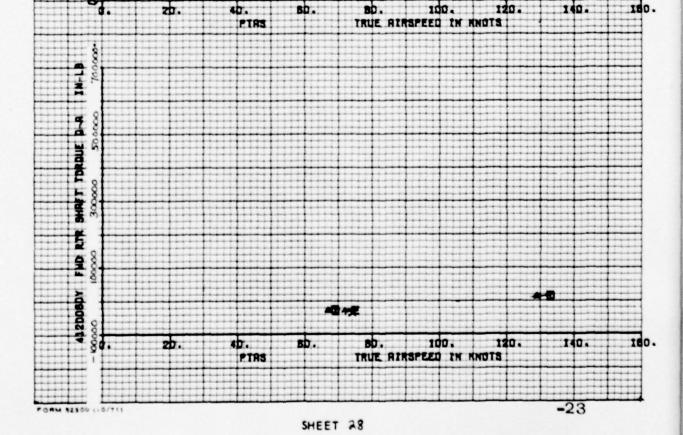




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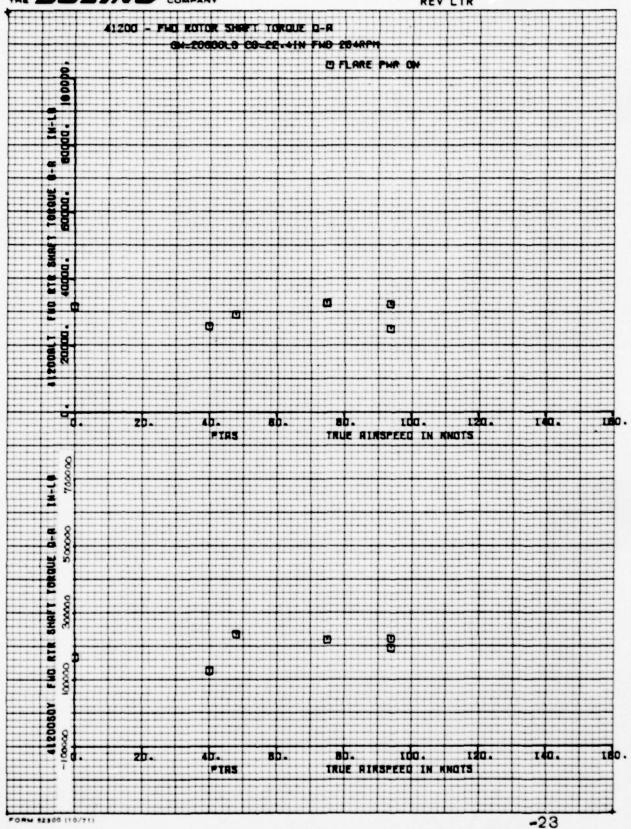
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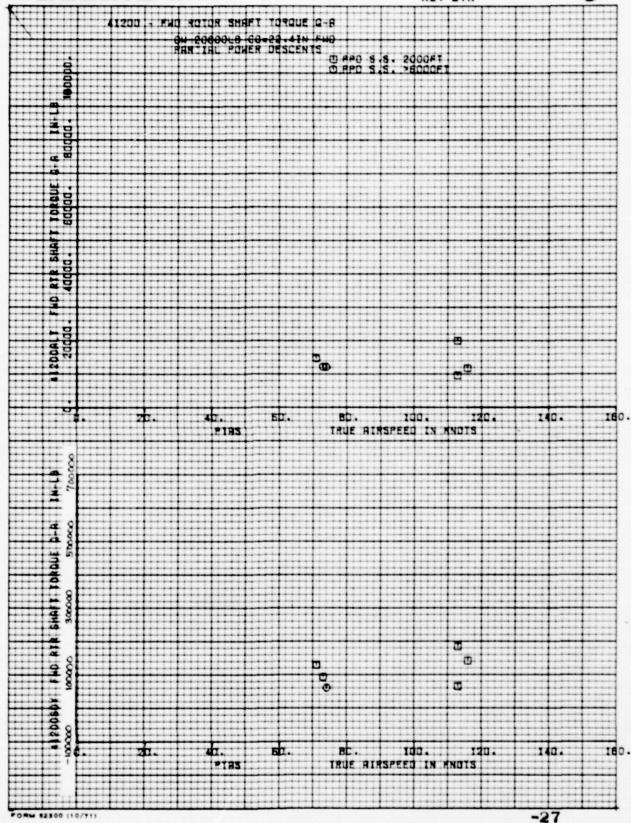


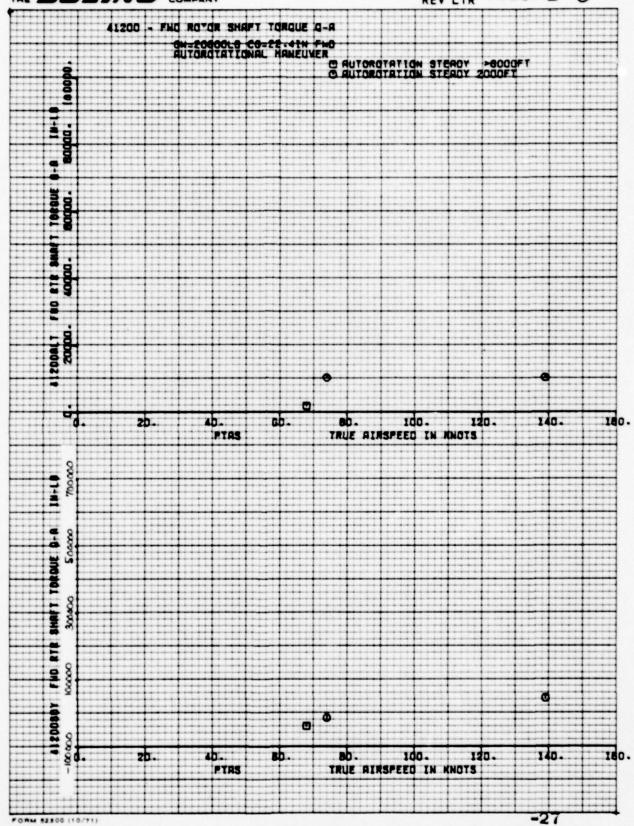


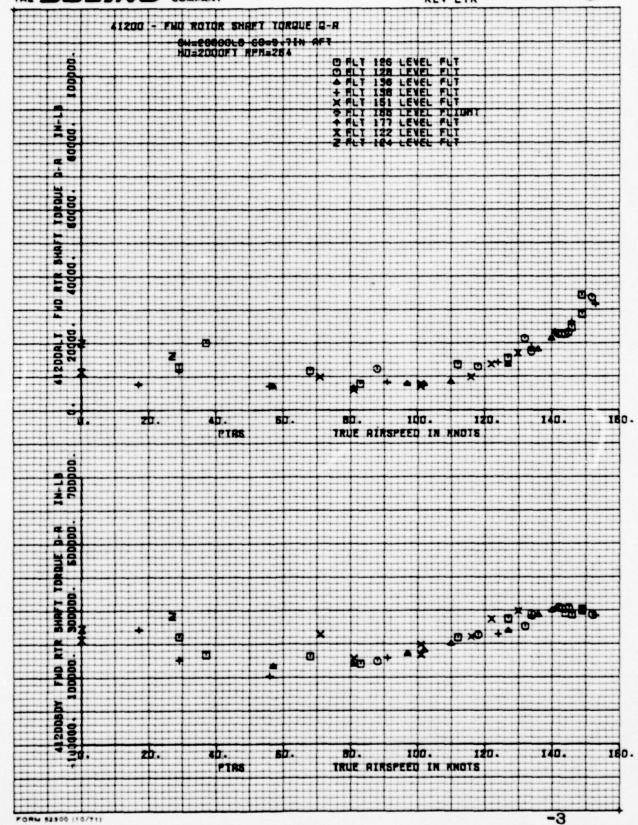
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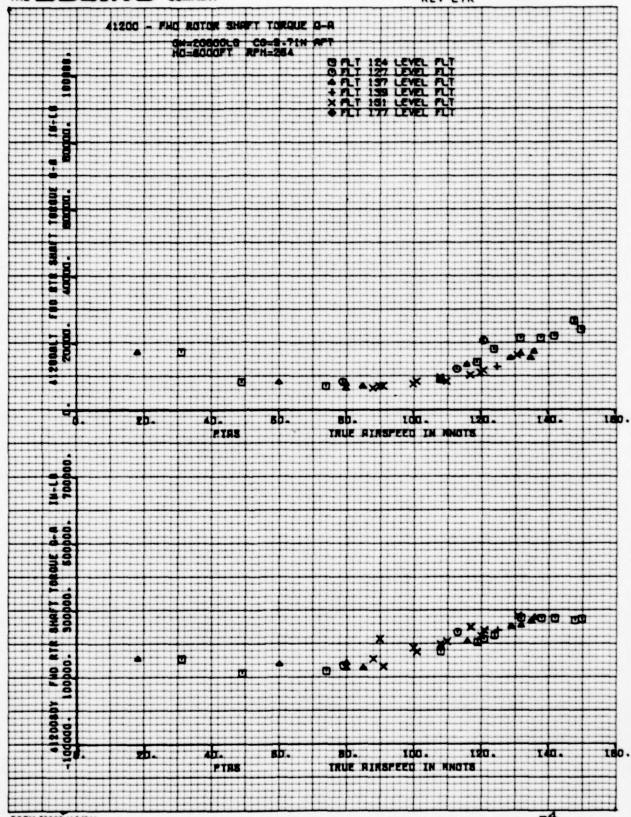
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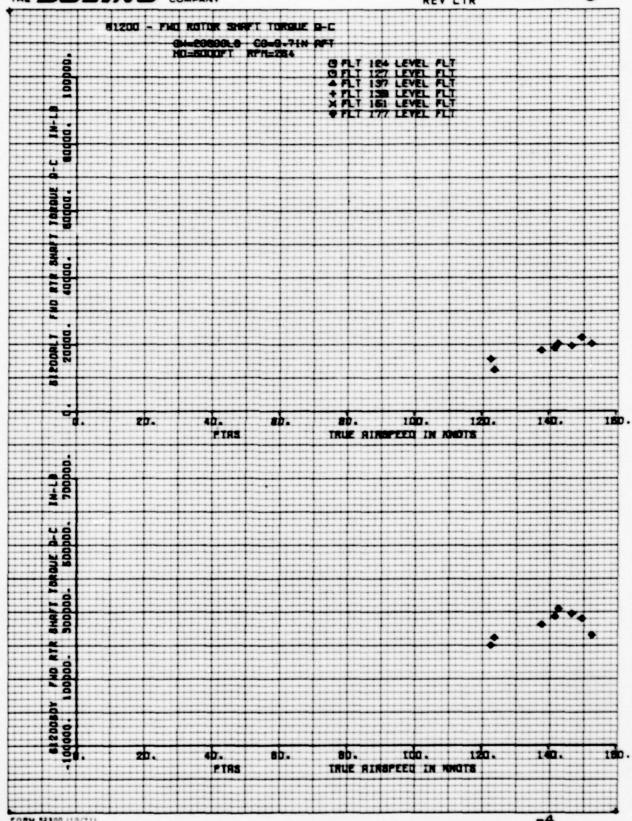






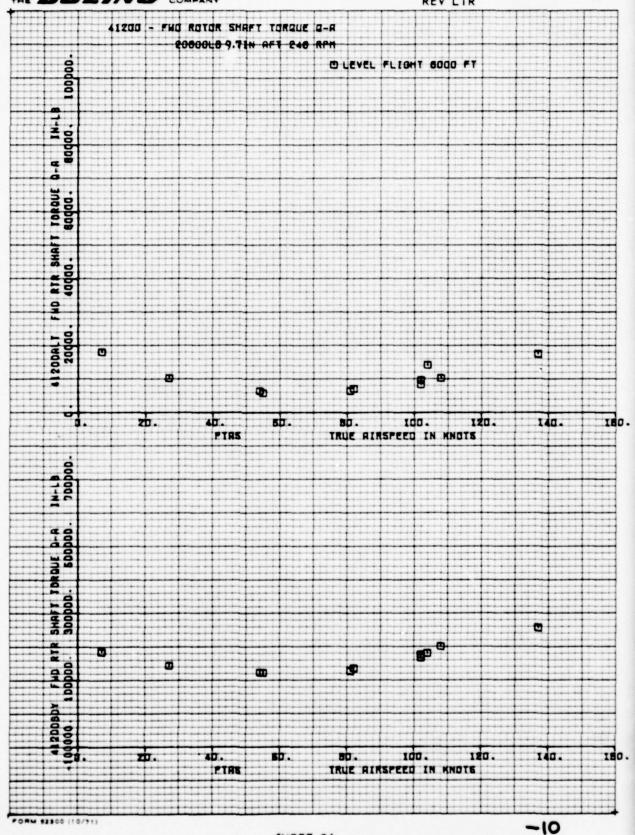


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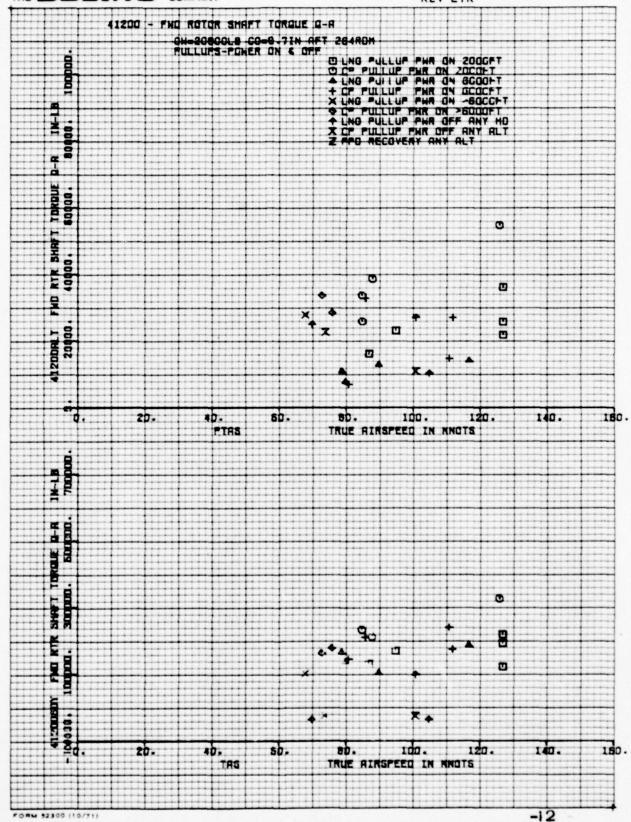
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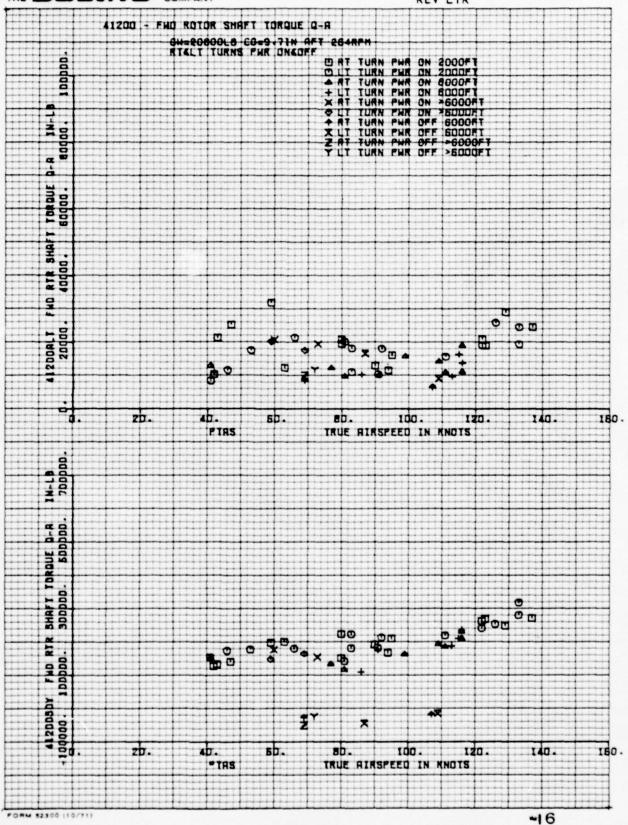
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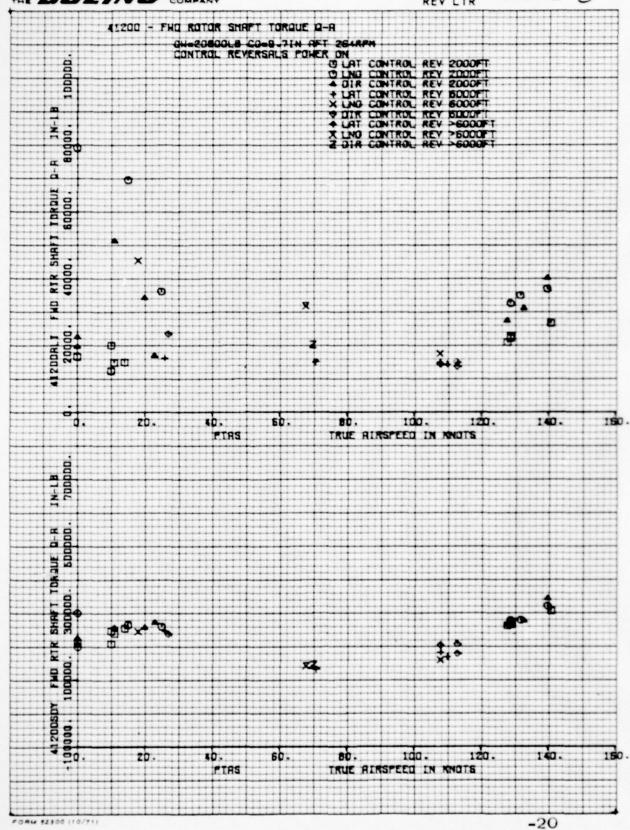
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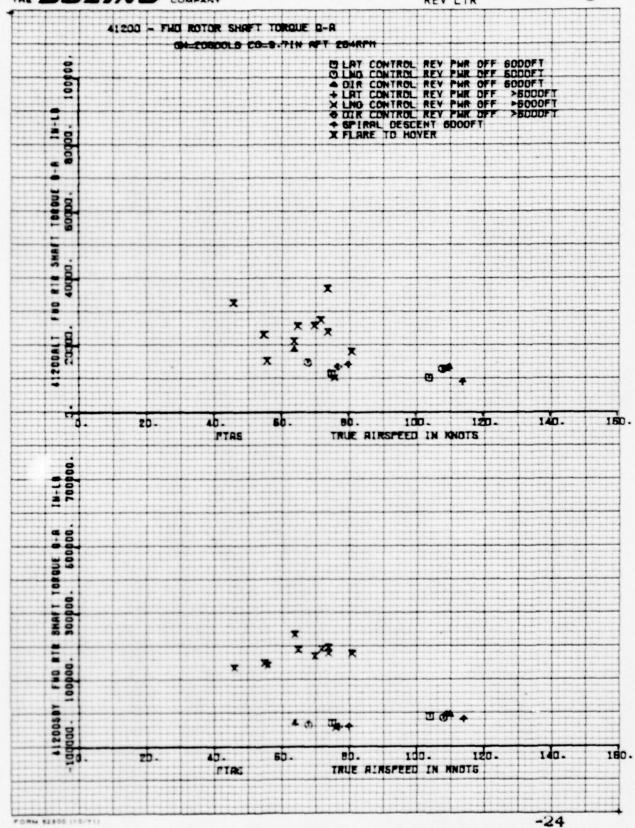
FORM \$2300 (10/71)

AD.

PTAS

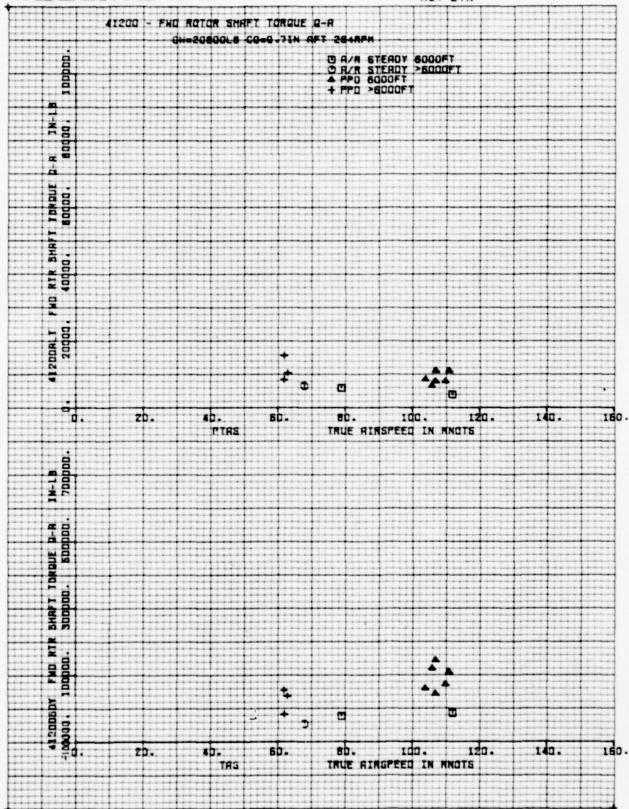


THE BOEING COMPANY



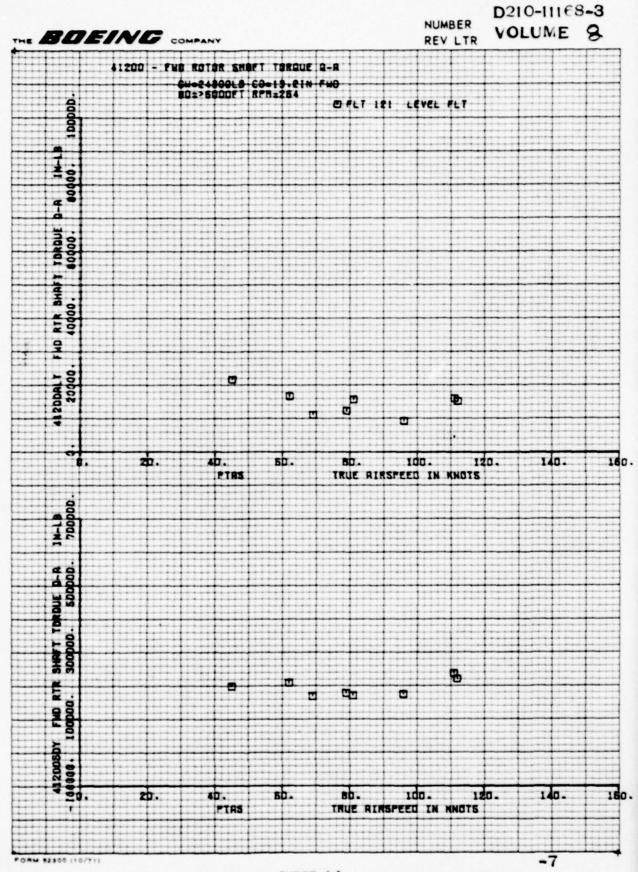
VOLUME &

-28



THE BOEING COMPANY

FORM \$2500 (10/71)



120.

100.

TRUE AIRSPEED IN KNOTS

140.

IBO.

VOLUME & THE BOEING COMPANY REV LTR 41200 - FHO ROTOR SHAFT TORQUE Q-R POWER ON & OFF PULLUFS US LONG PULLUF PHR ON 2000FT
OF PULLUF PHR ON 2000FT

LONG PULLUF PHR ON >6000FT

CP PULLUF PHR ON >6000FT

CP PULLUF PHR OFF 2000FT

SIDNO PULLUF PHR OFF >6000FT

CP PULLUF PHR OFF >6000FT + 0 0+ 0 zb. 50. 100. 120. 140. 180. TRUE RIRSPEED IN MNDTS PTRS 0 * M

SHEET 45

80.

BD .

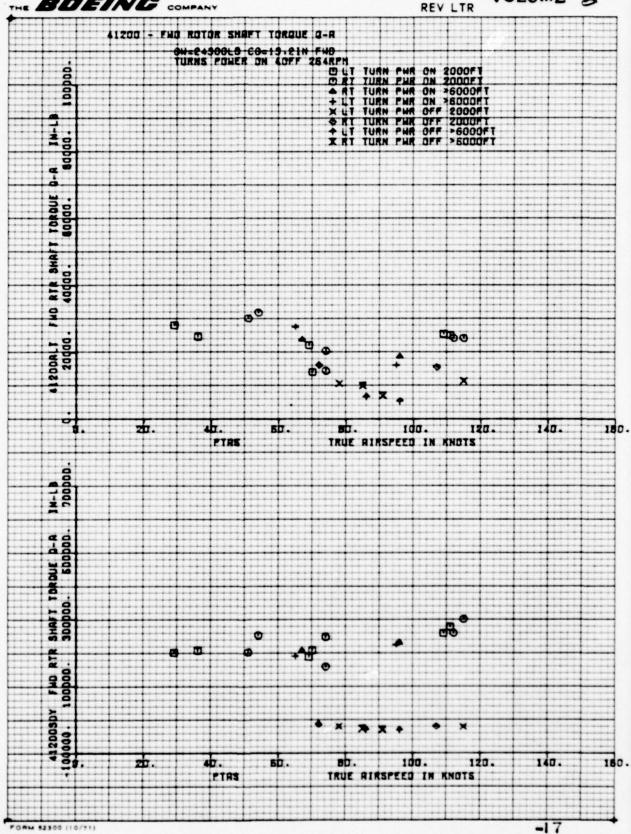
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PTAS

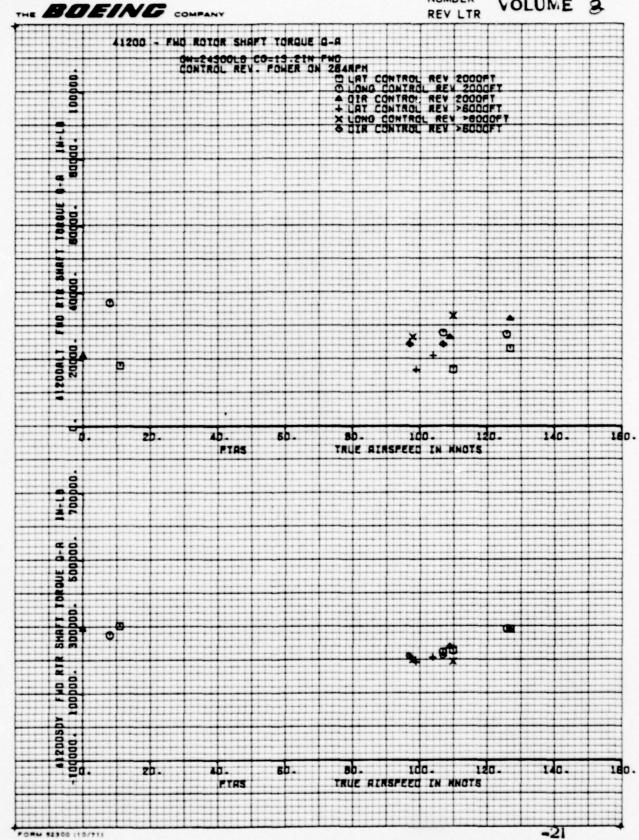
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FORM \$2300 (10/71)

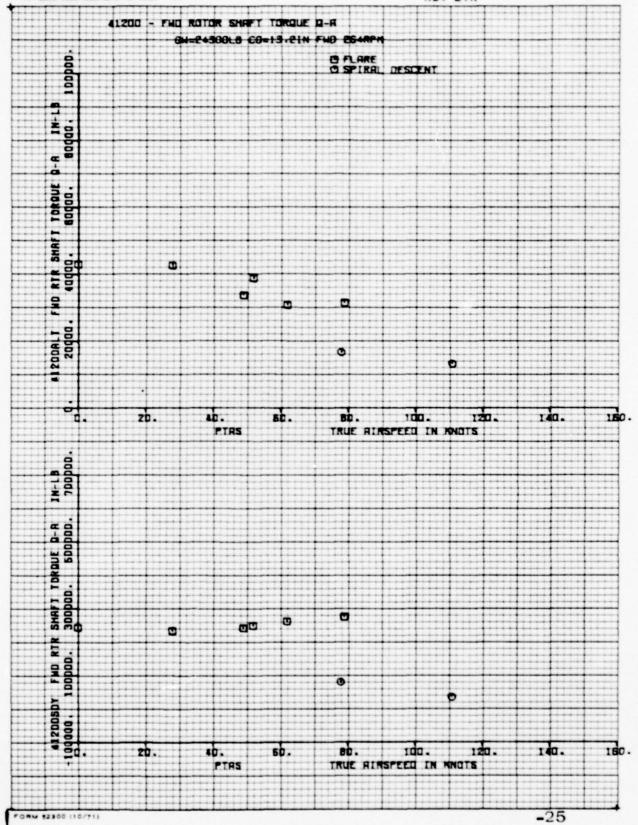
BOEING COMPANY

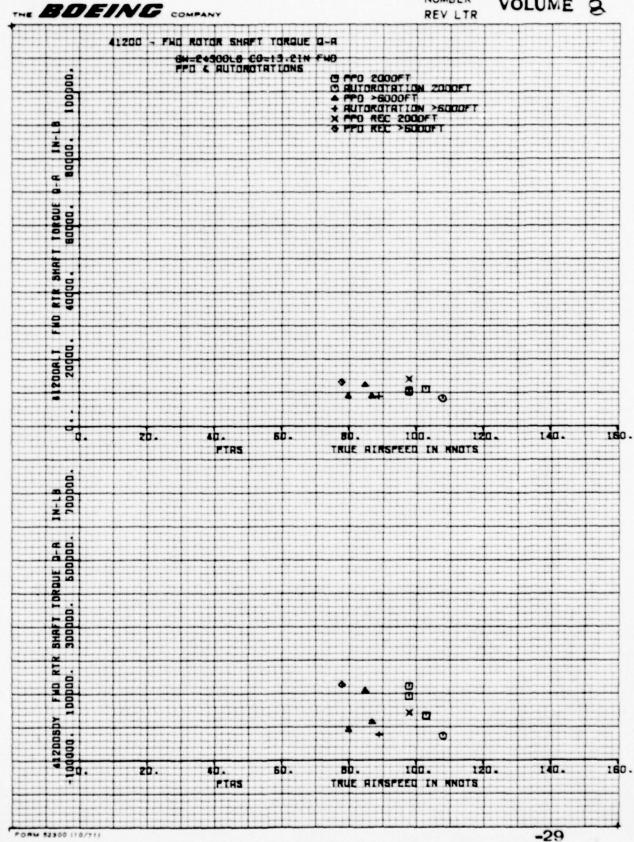


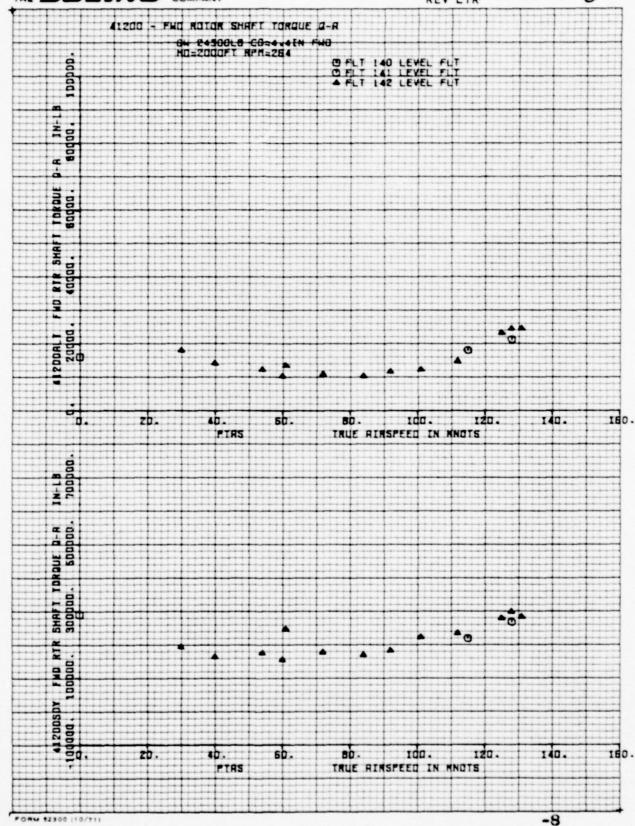
VOLUME &



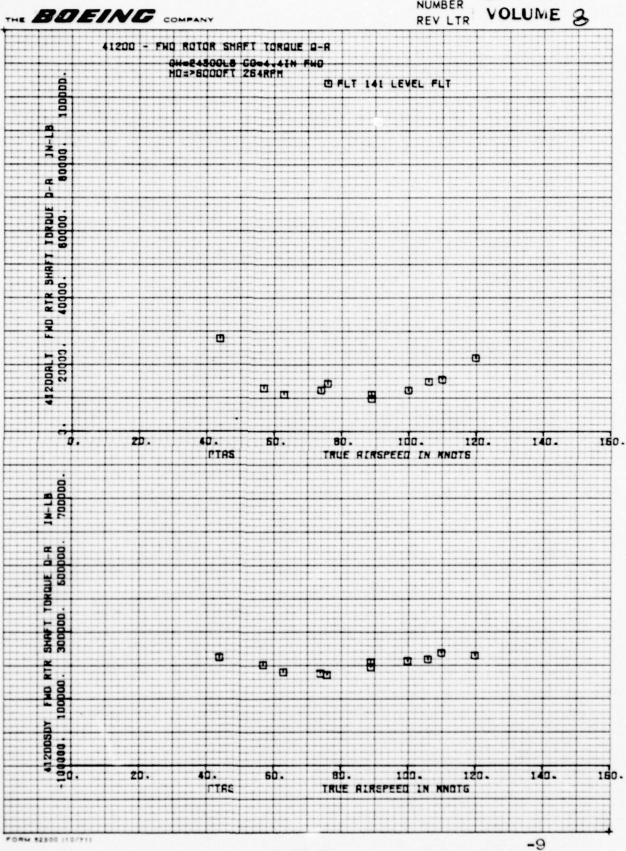
THE BOEING COMPANY REV LTR VOLUME &

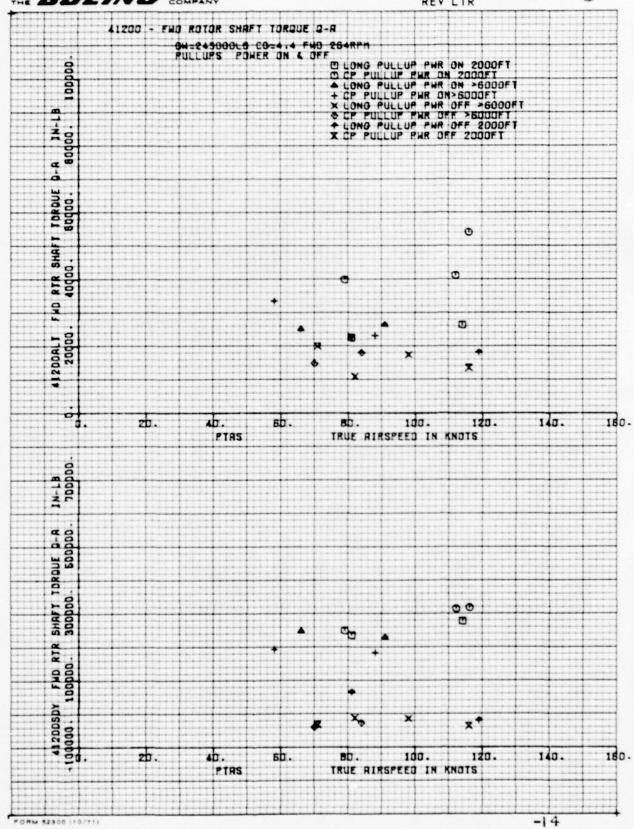


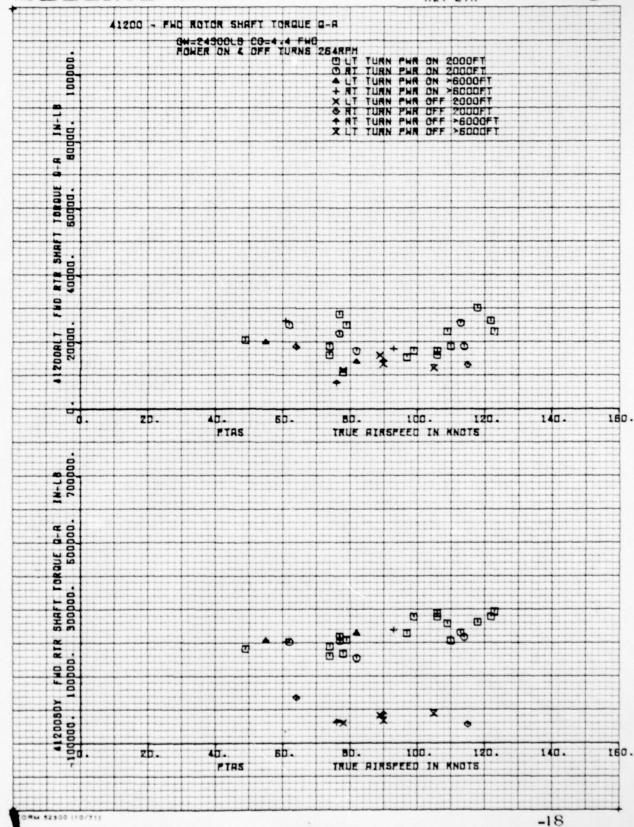


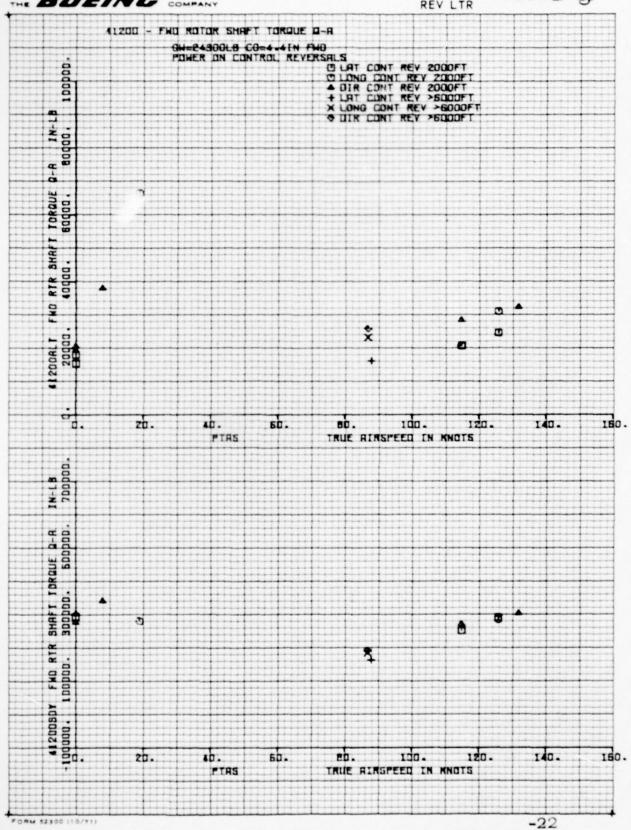


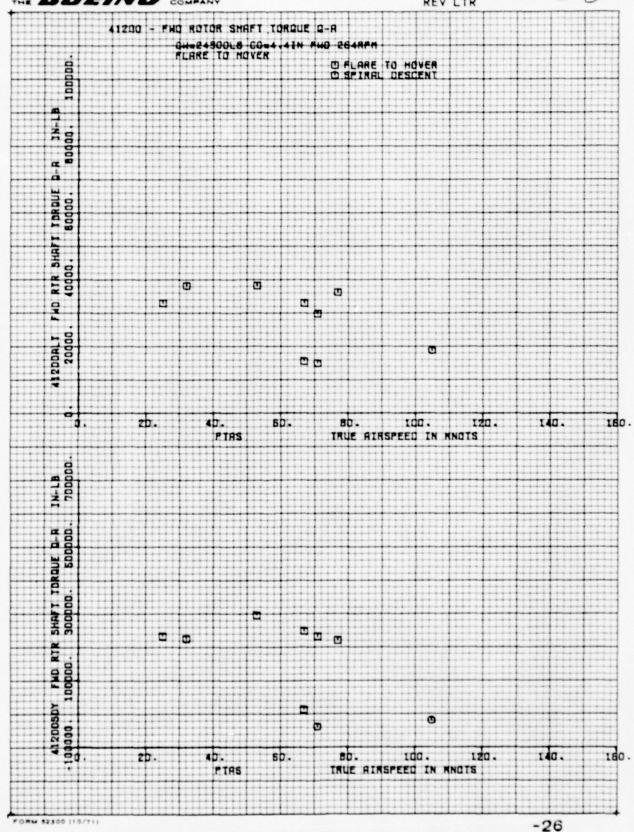








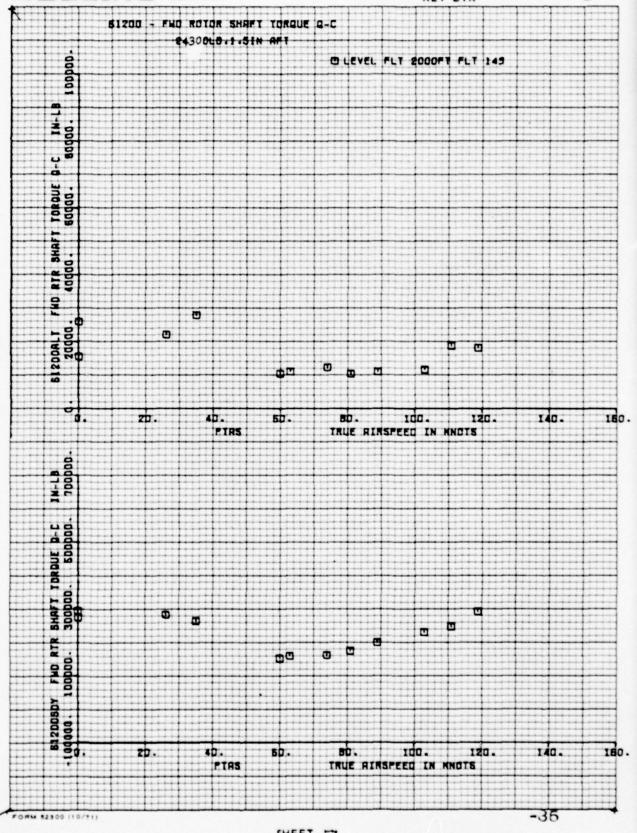




NUMBER VOLUME &

THE BOEING COMPANY REV LTR 41200 - FHO ROTOR SHAFT TORQUE Q-A OH 24300L8 CG-4 4[N FHD 264RPM O A/R STERDY 40. 140. 50. 100. 180. 80 . 120 . TRUE RIRSPEED IN MNOTS PTRS TOODOO SOODOO SOODOO 0 0 40. 160 . 100. 140. 5D. 80 . TRUE RIRSPEED IN KNOTS PTAS -30

SHEET 56



PREPARED BY: J. Bendo

THE BOEING COMPANY DATE:

8/28/78

NUMBER D210-11168-3 REV LTR Volume 8

MODEL NO.

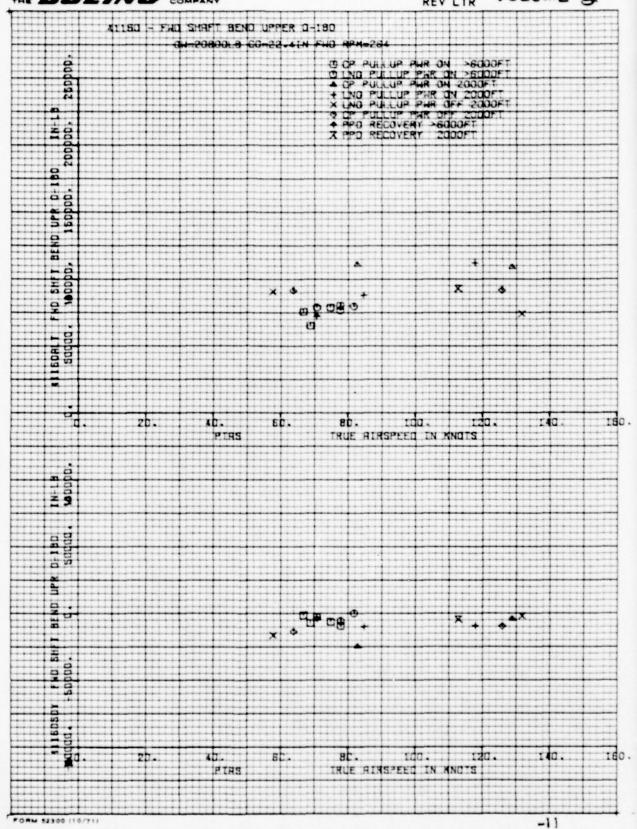
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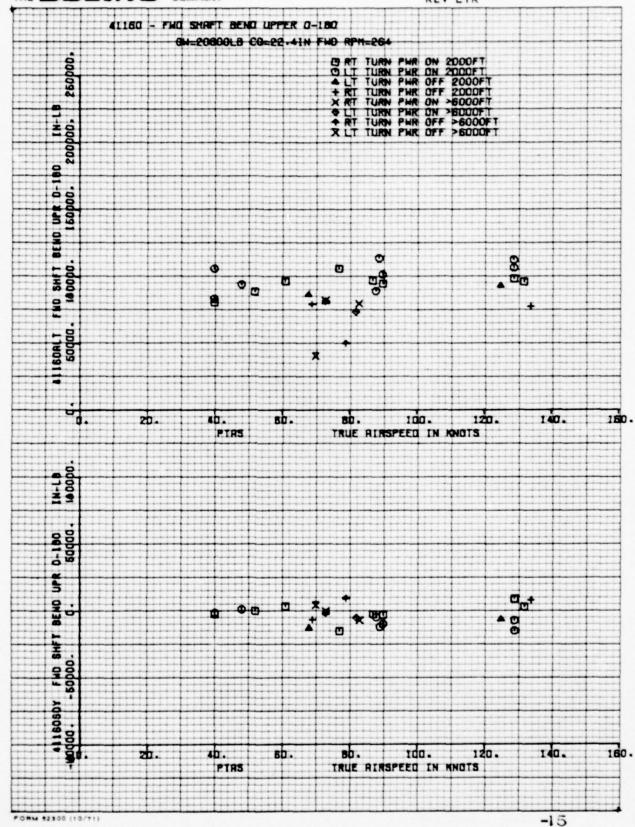
NUMBER REV LTR

41160 - FHO SHRFT BEND UPPER 0-180 ID SHRFT BENU UFTER A FHO DH-20800L8 C0-22-41N FHO HD-RBOYE BOOOFT RFM-264 + FLT 115 LEVEL FLT 40. ıda. FIRS TRUE RIRSPEED IN MNOTS 40. 80. 100. TRUE RIRSPEED IN MNOTS PTAS

THE BOEING COMPANY

FORM \$2300 (10/71)



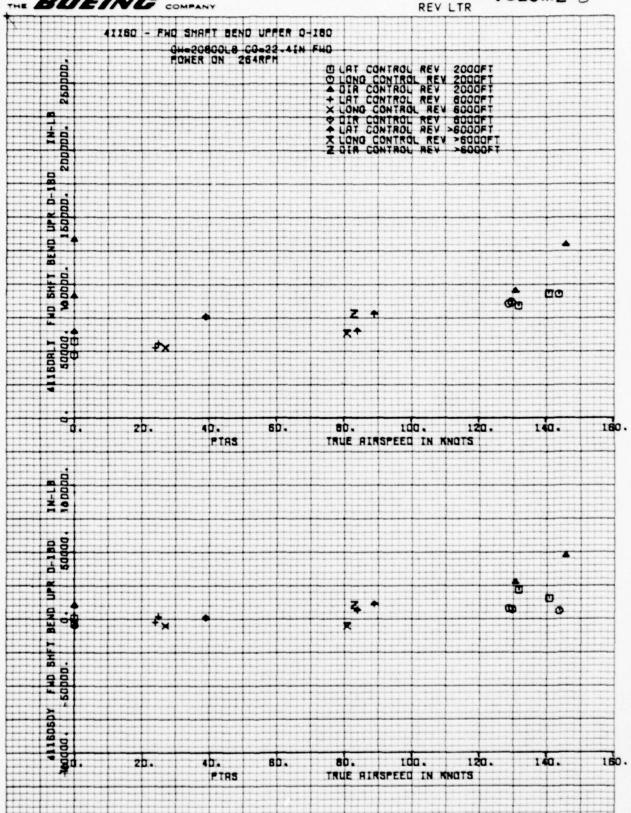


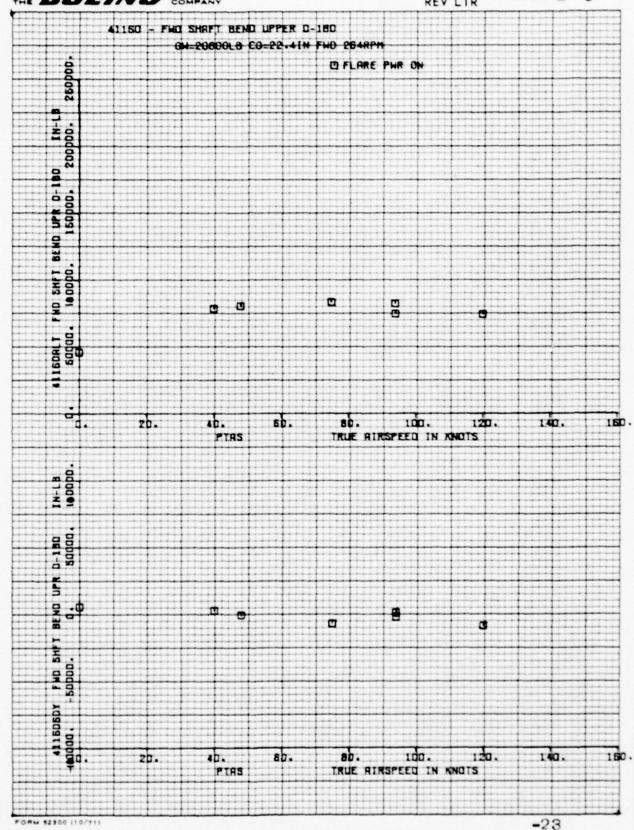
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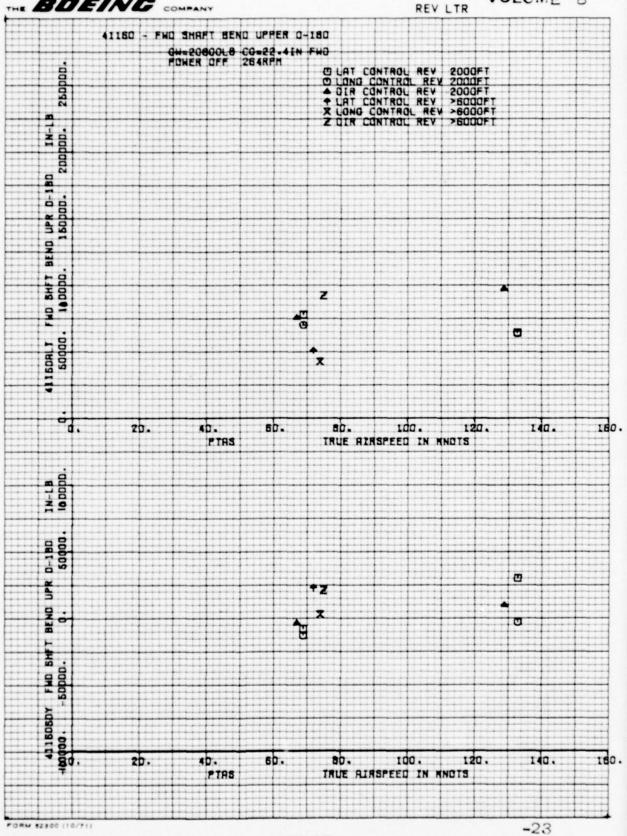
FORM \$2300 (10/71)

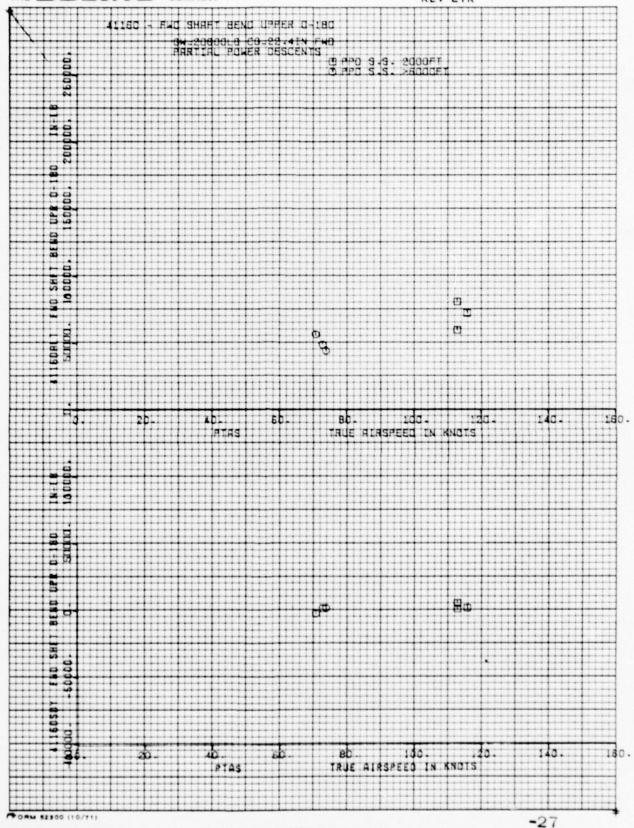
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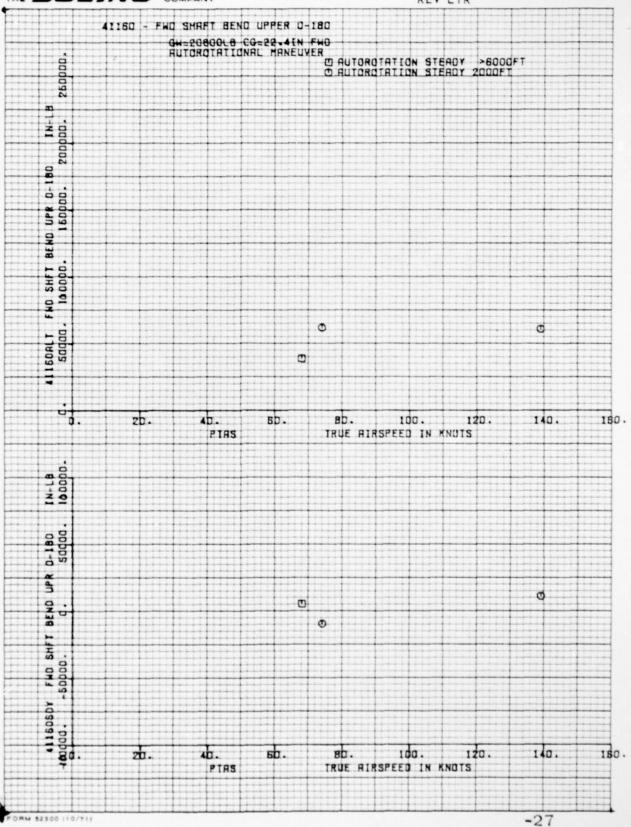
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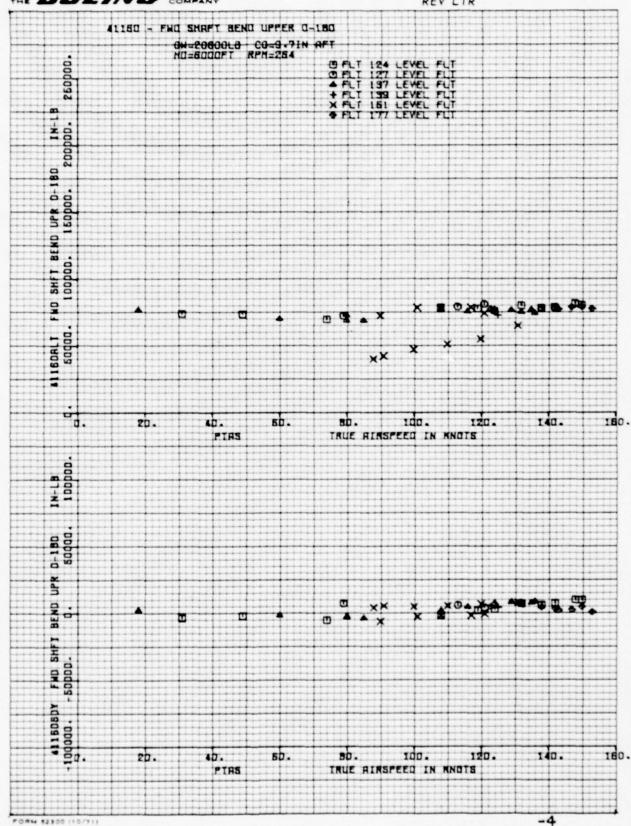


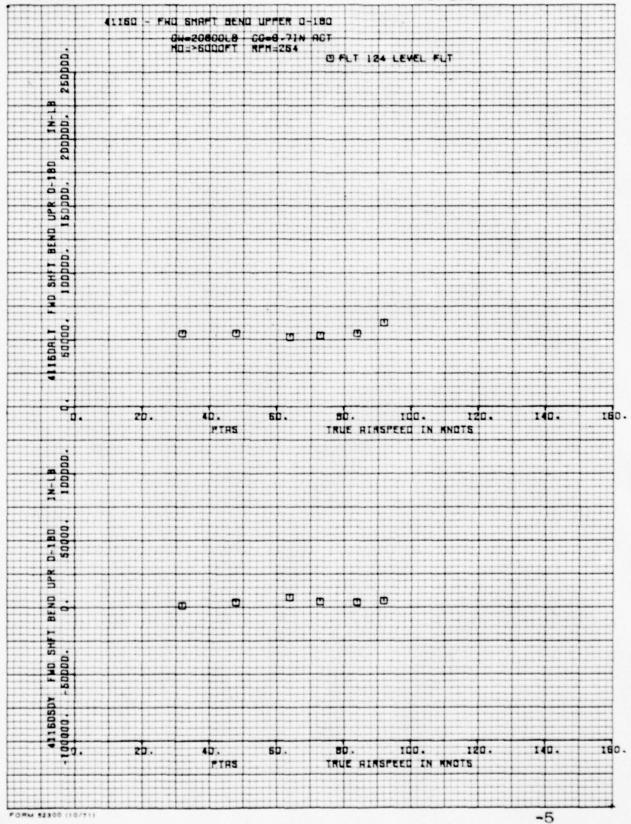






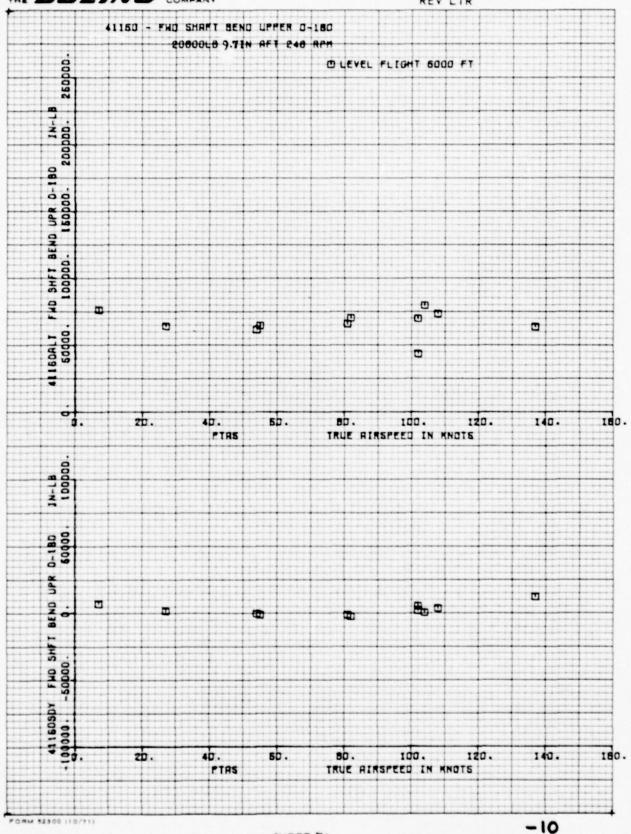


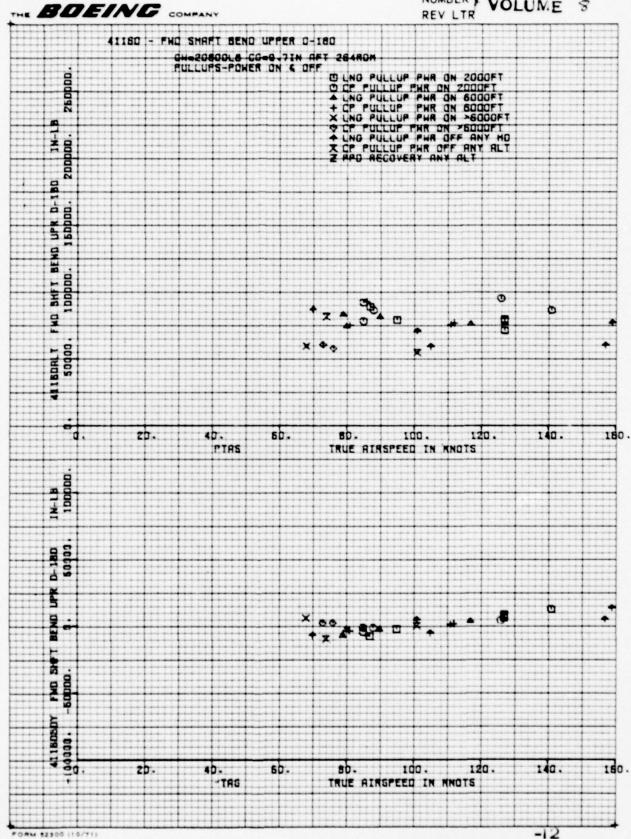




THE BOEING COMPANY

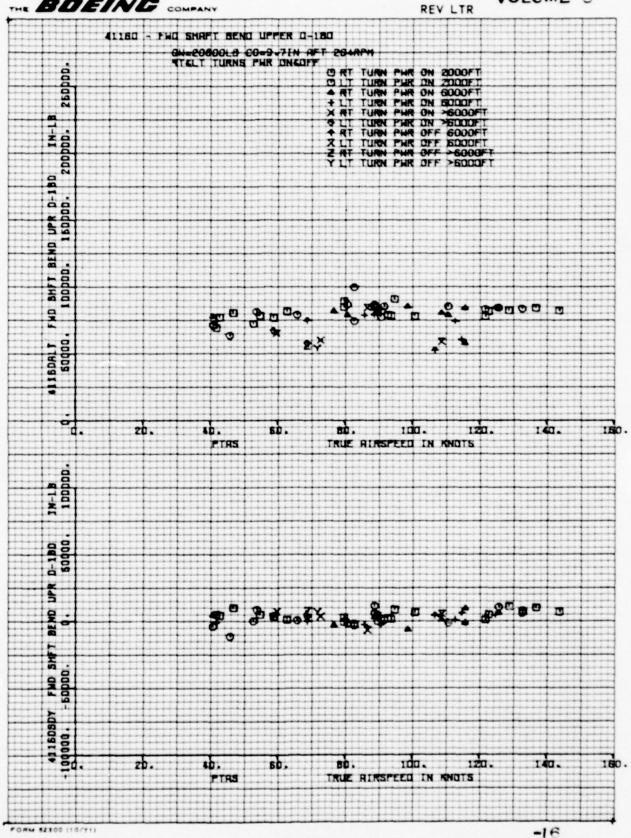
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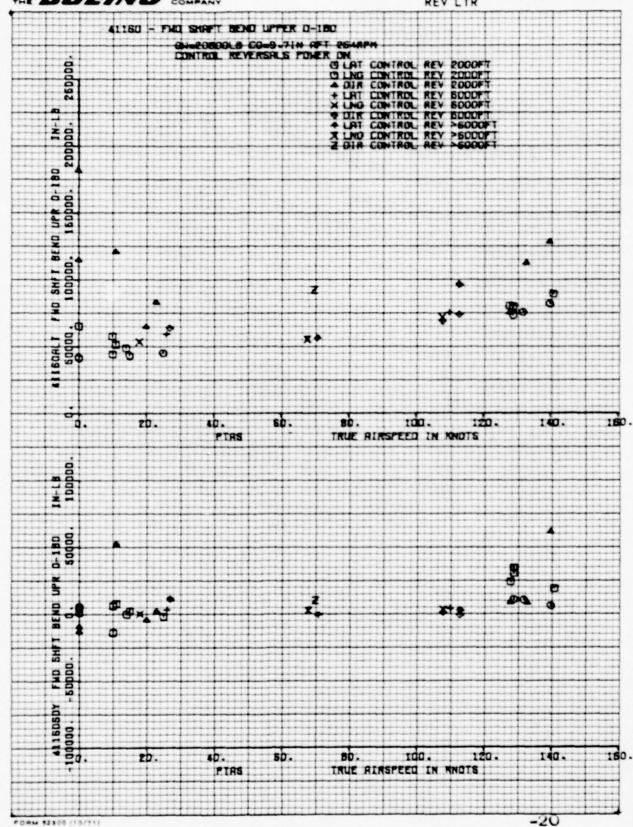


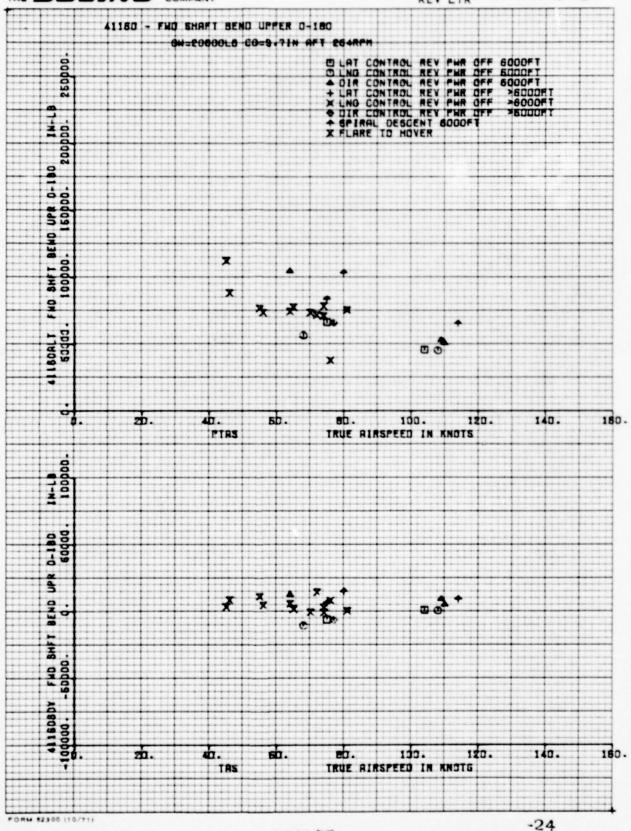


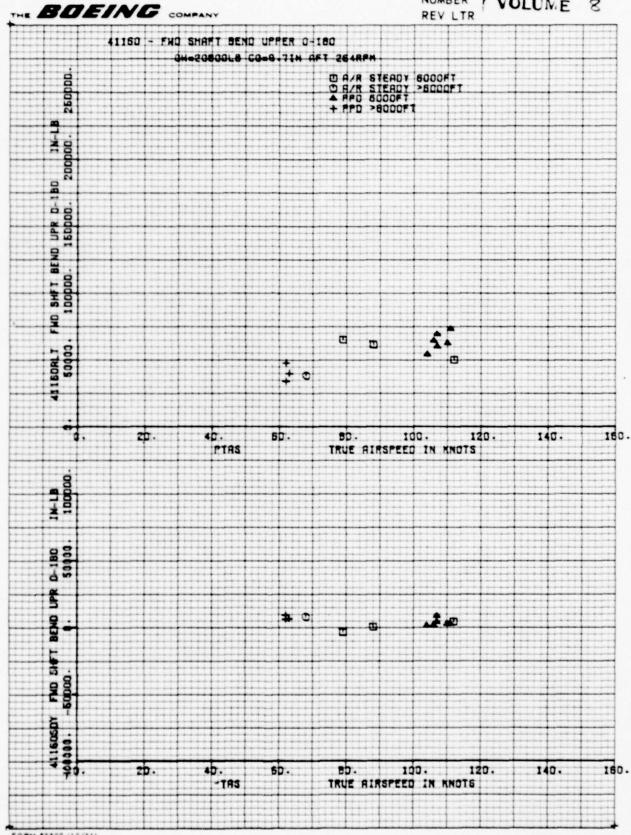
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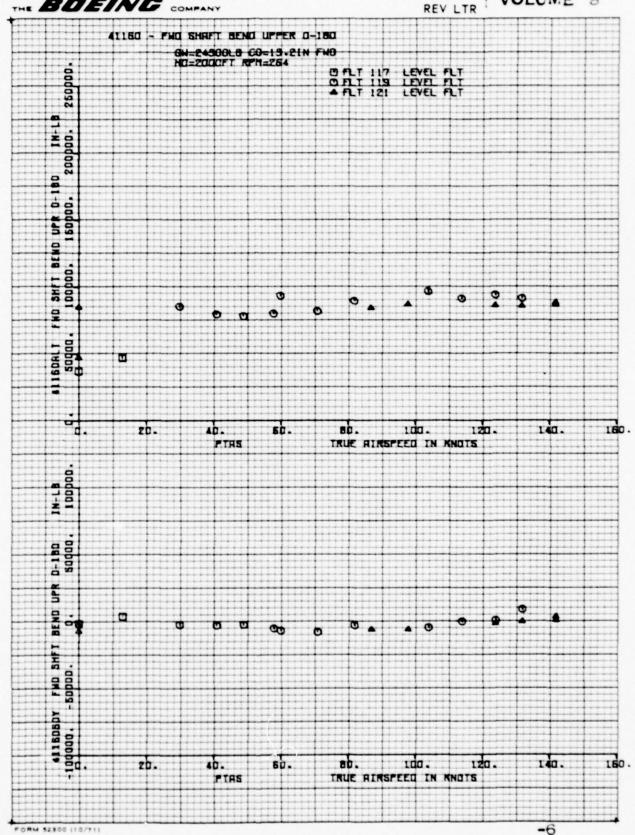
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NUMBER , VOLUME 8 THE BOEING COMPANY REV LTR 41150 - FHO SHAFT BEND UPPER 0-180 \$H-24500L8 CG-13.2IN FHO 260000 BALT 121 LEVEL ALT FKD SHFT BEND UPR D-180 100000. 160000. 2 0 0 20. 4D. 100. 140. 150 . BD. PTRS TRUE RIRSPEED IN KNOTS! 1 50. 80. Ido. 120. 140. 160. 4D. PTRS TRUE AIRSPEED IN MNOTS FORM \$2300 (10/71) -7

SHEET 78

D210-11168-3

THE BOEING COMPANY REV LTR 41160 - FHO SHAFT BEND UPPER 0-180 ON-24500LB CO-15.21N FWD D LONG FULLUF PHR ON 2000FT
O CP PULLUP PHR ON 2000FT
A LONG PULLUP PHR ON >6000FT
+ CP FULLUP PHR ON >5000FT
X CP PULLUP PHR OFF 2000FT
O LONG FULLUP PHR OFF 2000FT
+ LONG PULLUP PHR OFF >6000FT
X CP PULLUP PHR OFF >5000FT 260000. 41180ALT FWO SHFT BEND UPR 0-180 IN-LB 50404. 100000. 150000. 200000. 0 0 AD. 50. Bb. 100. 140. ZD. 180. PTRS TRUE RIRSPEED IN KNOTS 50000 BEND UPR m[‡] 8x m ⋅ 411805DY FWD SHFT 120. AD. 80. Ido. 160.

TRUE RIRSPEED IN MNOTS

-13

ZD.

FORM \$2300 (10/71)

PTRS

NUMBER VOLUME REV LTR

THE BOEING COMPANY 41160 - FNO SHAFT BEND UPPER 0-180 OH=24900L9 CO=19.2IN FNO
TURNS POWER ON 40FF 254RPH

O RT TURN PWR ON 2000FT

ART TURN PWR ON 2000FT

+ UT TURN PWR ON 2000FT

+ UT TURN PWR ON 2000FT

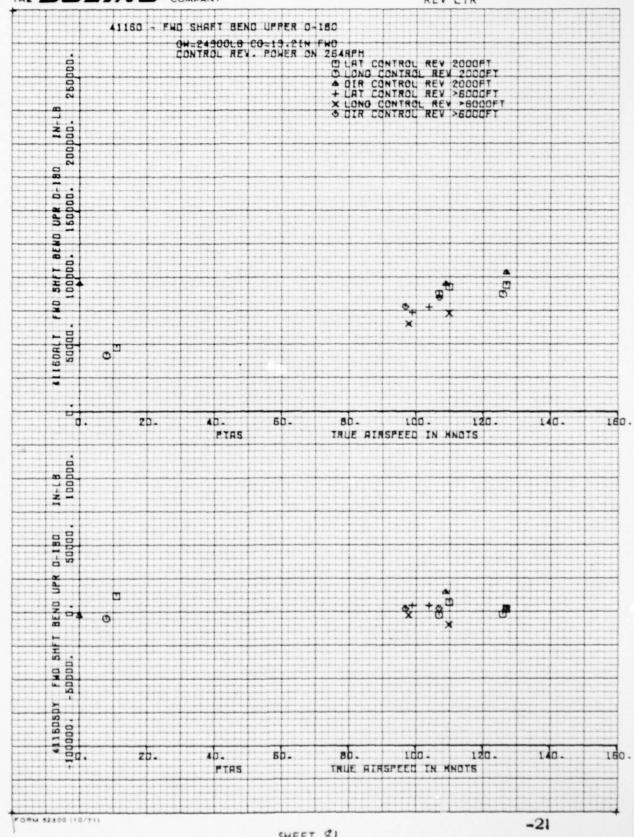
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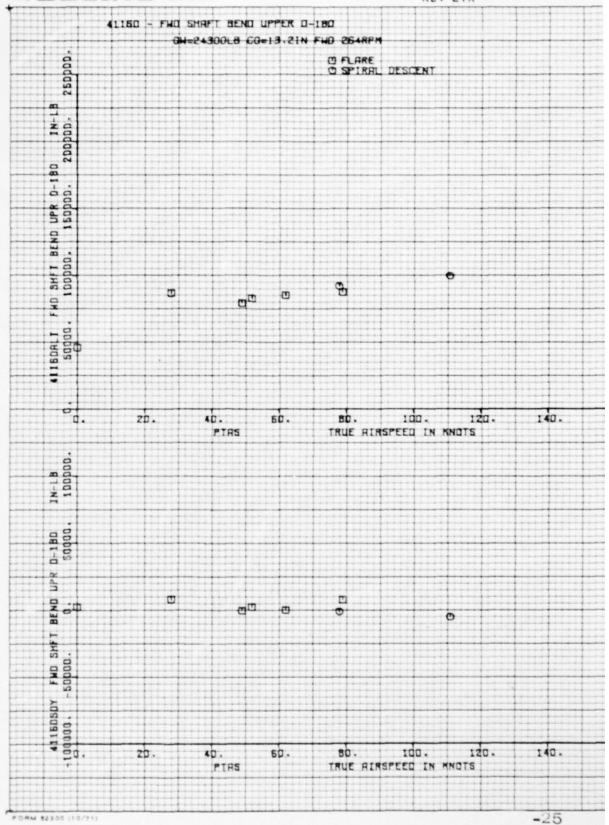
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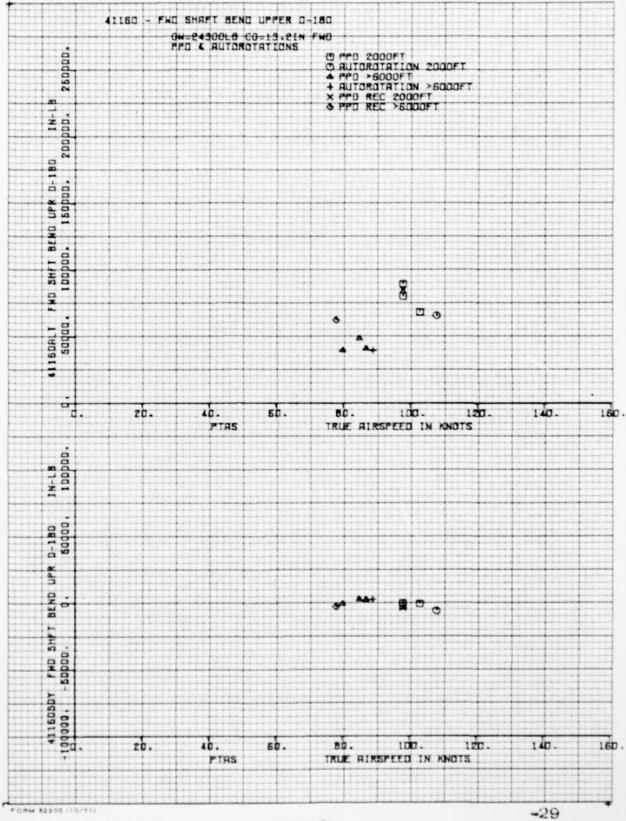
+ UT TURN PWR OFF 2000FT

X RT TURN PWR OFF >6000FT

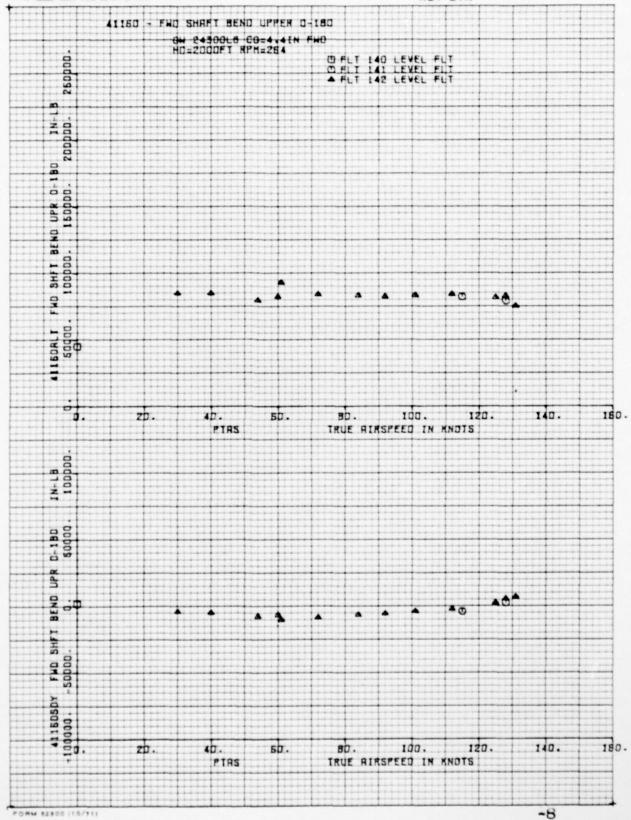
X RT TURN PWR OFF >6000FT 250000 180 IN-LB 200000-FNO SHFT BEND UPR 0-180 900 8 ° × 00 \$1160ALT F JX 50. 100. 120. 140. 160 . zb. AD. 80. PTAS TRUE AIRSPEED IN KNOTS IN-LB IDODOD. 50000 UPR * X + BEND G. 0 00 +*(D, 0 × a Pro-DY FUD SHFT B 411605DY -1000000. zb. 140. 160. AD. 60. FTAS TRUE RIMSPEED IN MNOTS -17 FORM \$2300 (10/71)







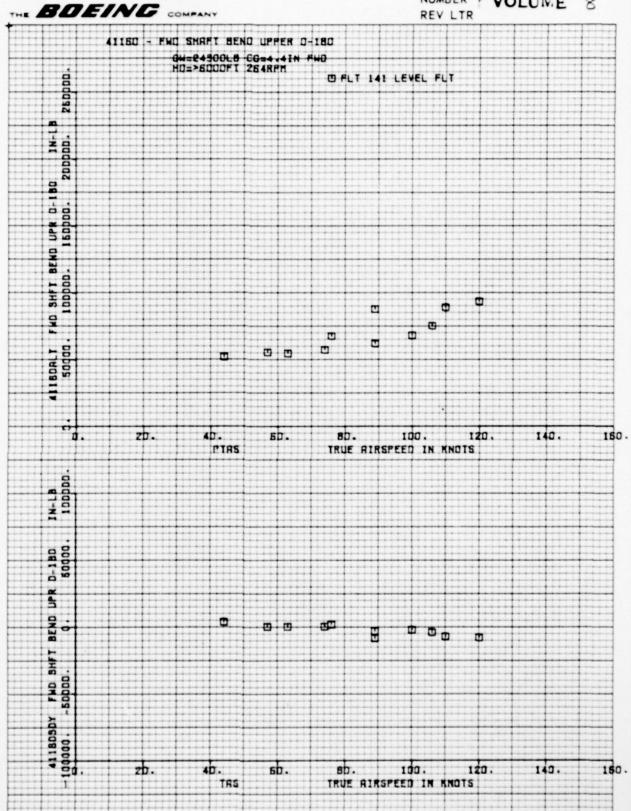
NUMBER | VOLUME 8



-9

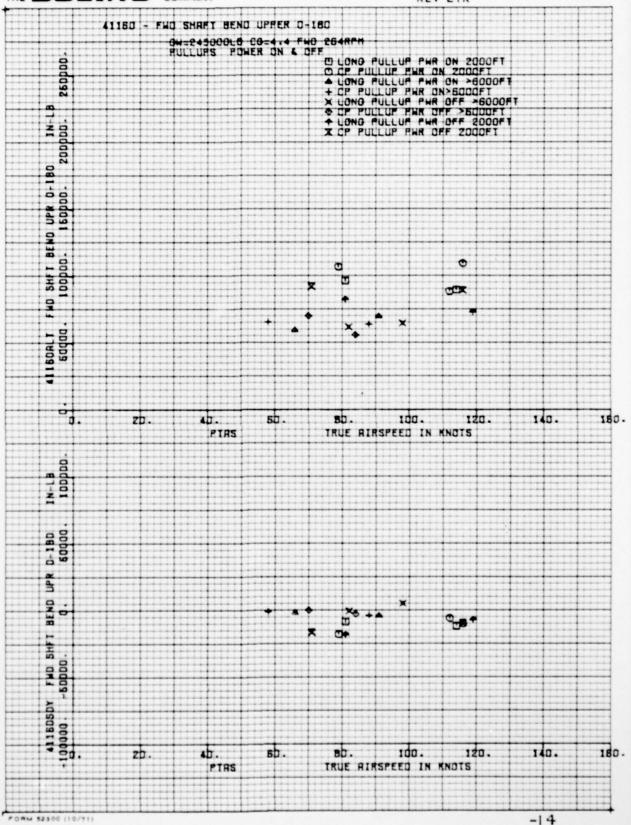
NUMBER | VOLUME 8

REV LTR

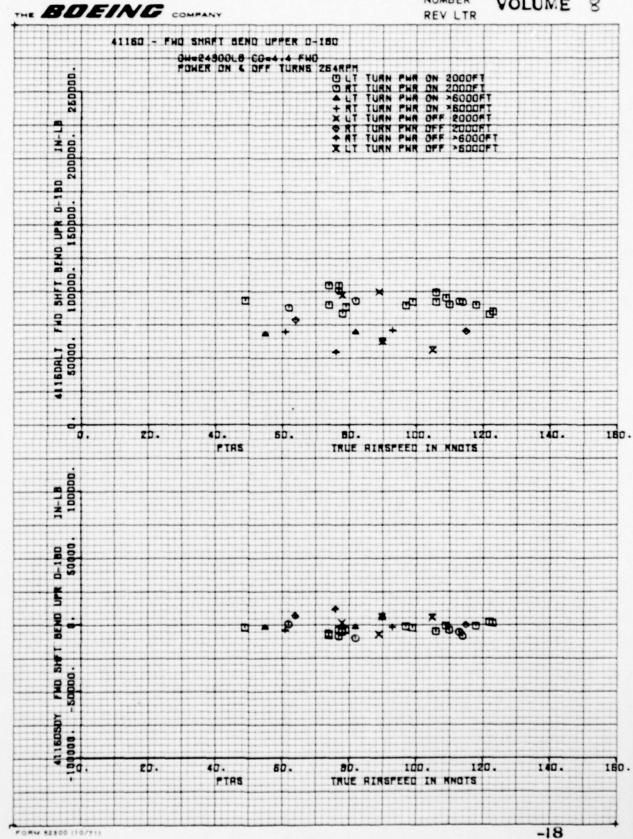


FORM \$2300 (10/71)

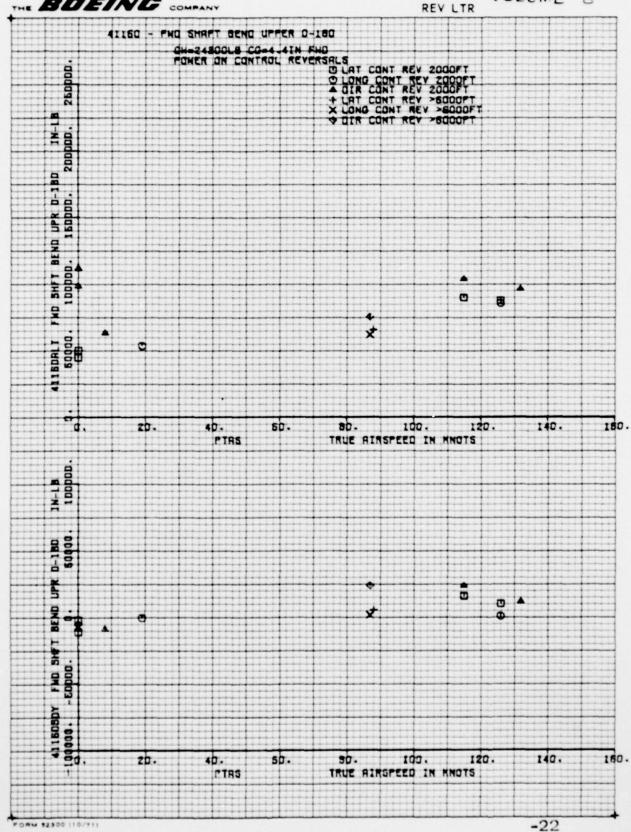
NUMBER | VOLUME 8

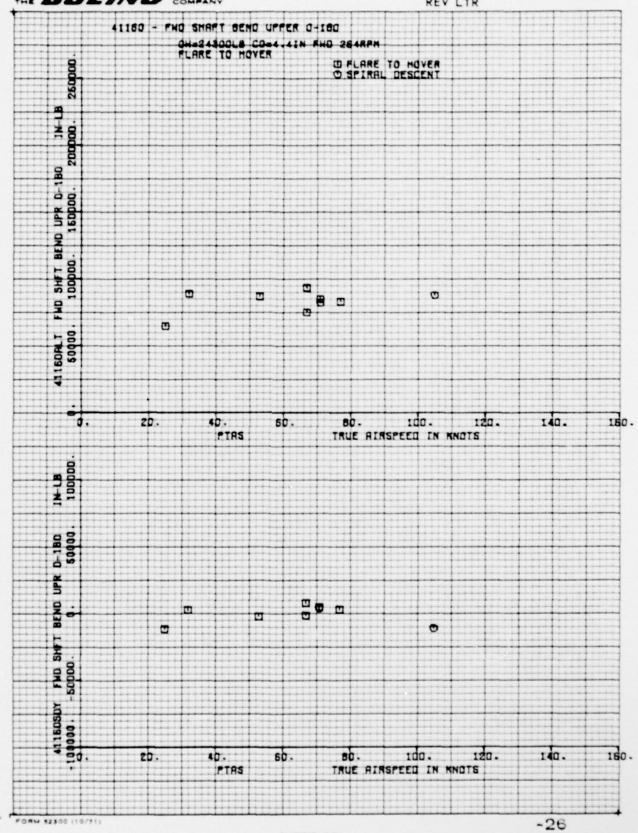


NUMBER REV LTR

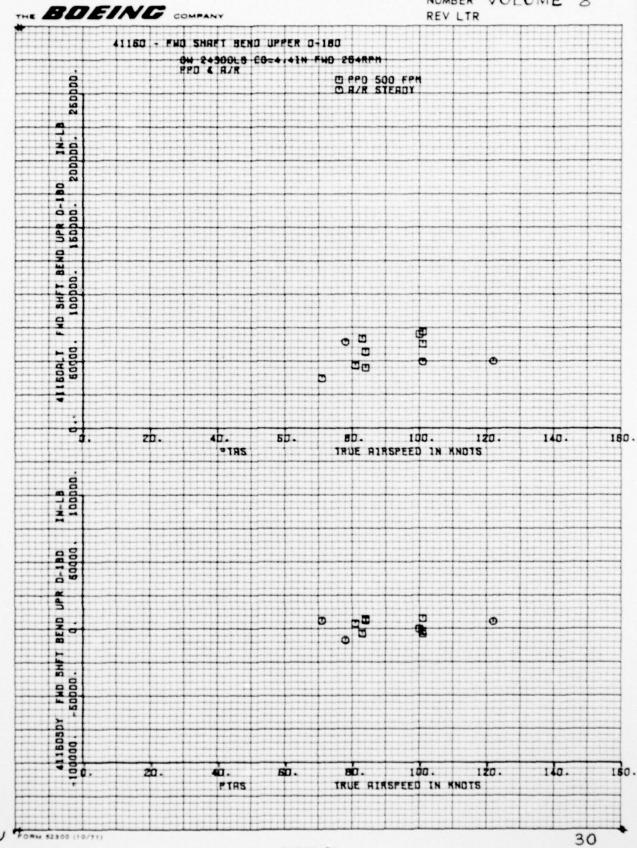


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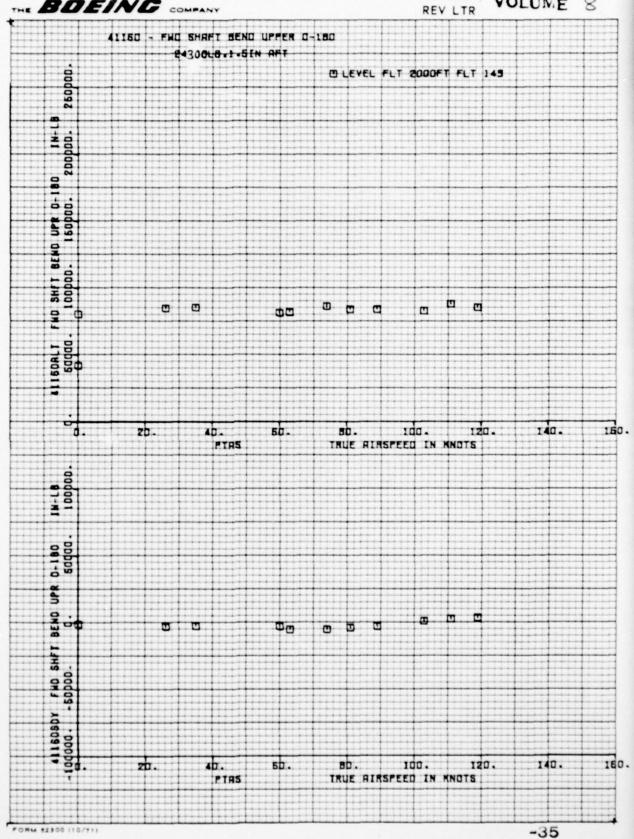




NUMBER VOLUME 8



NUMBER



PREPARED BY: J. Bendo

THE BOEING COMPANY DATE:

8/28/78

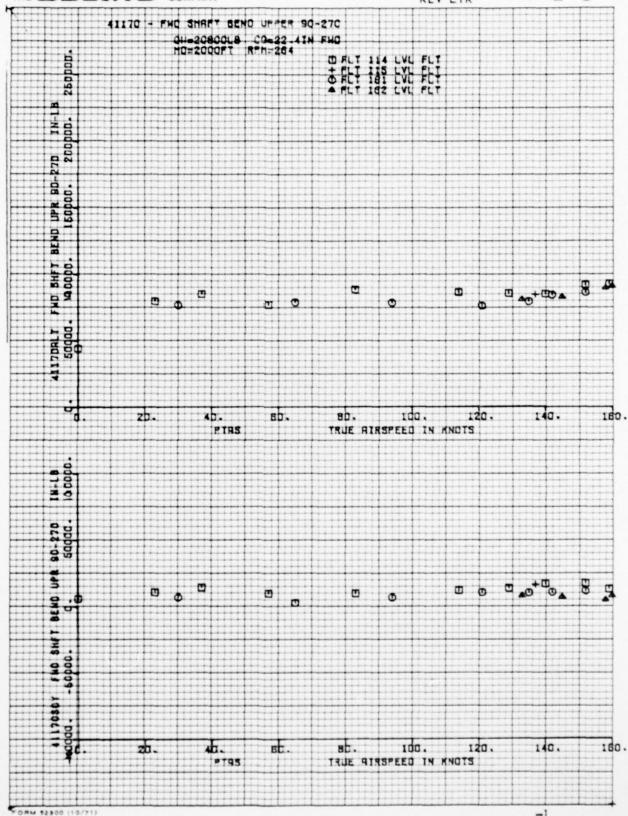
NUMBER D210-11168-3 REV LTR Volume 8

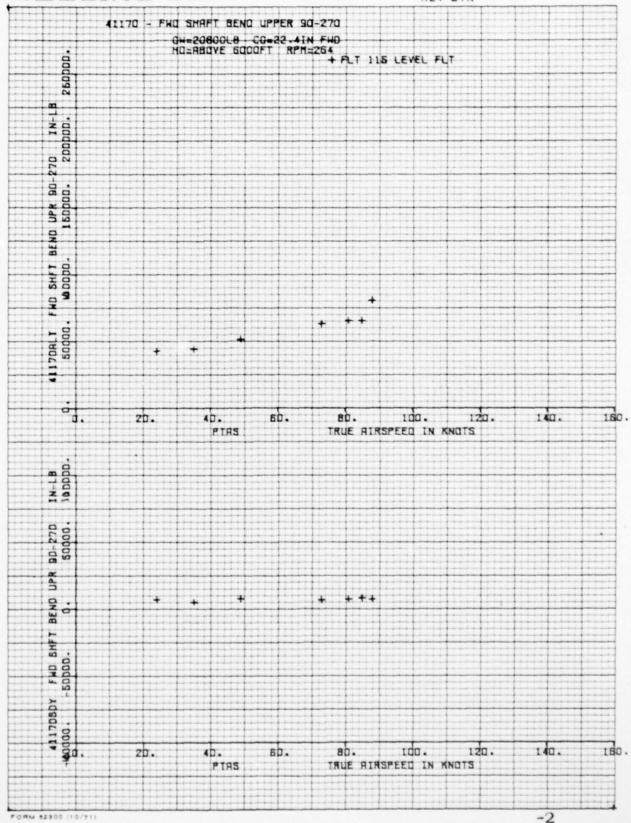
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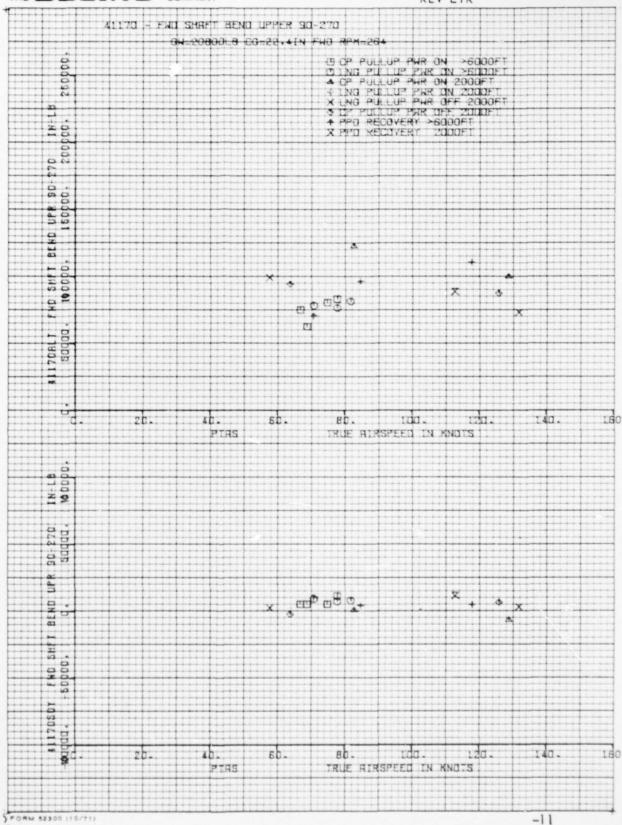
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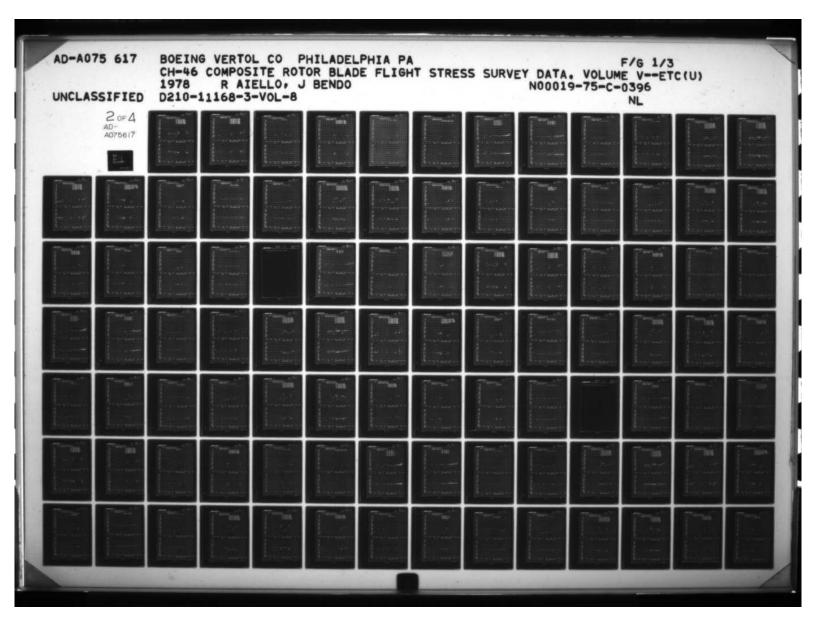
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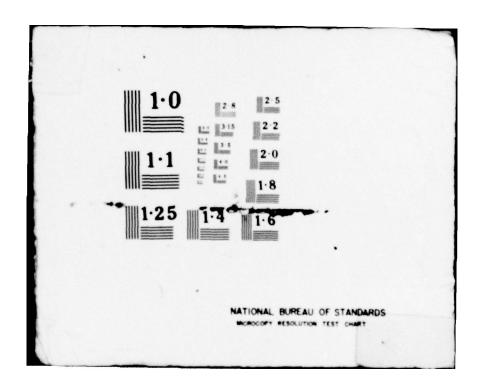
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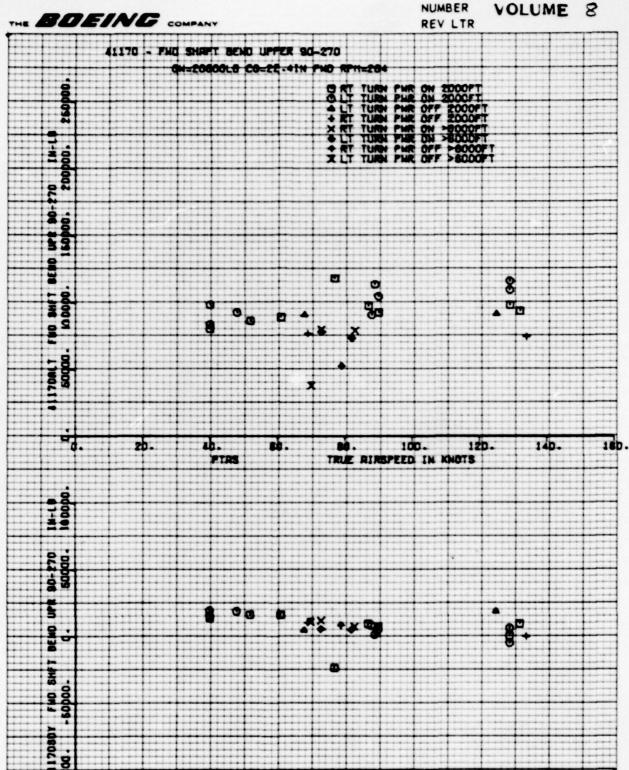




140.

-15

180.



100.

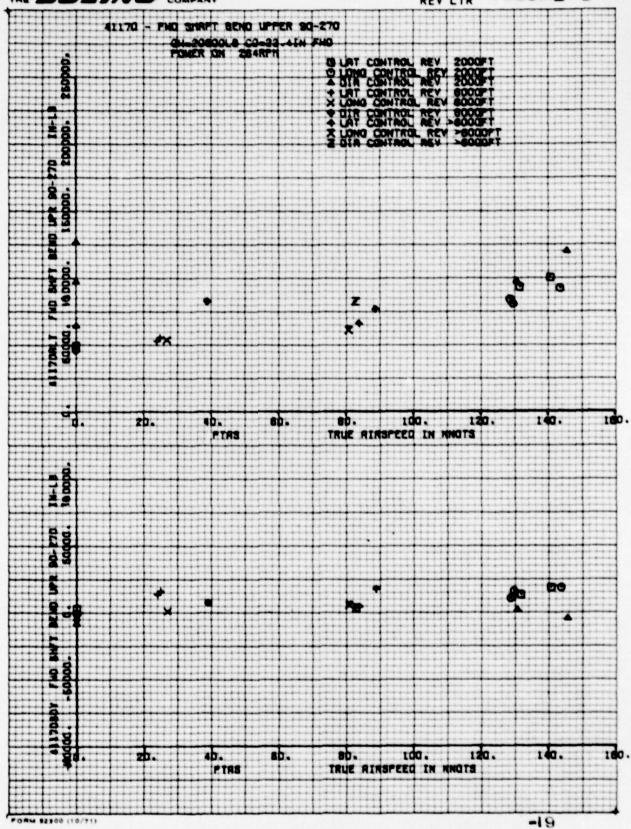
TRUE RIRSPEED IN MOTS

120.

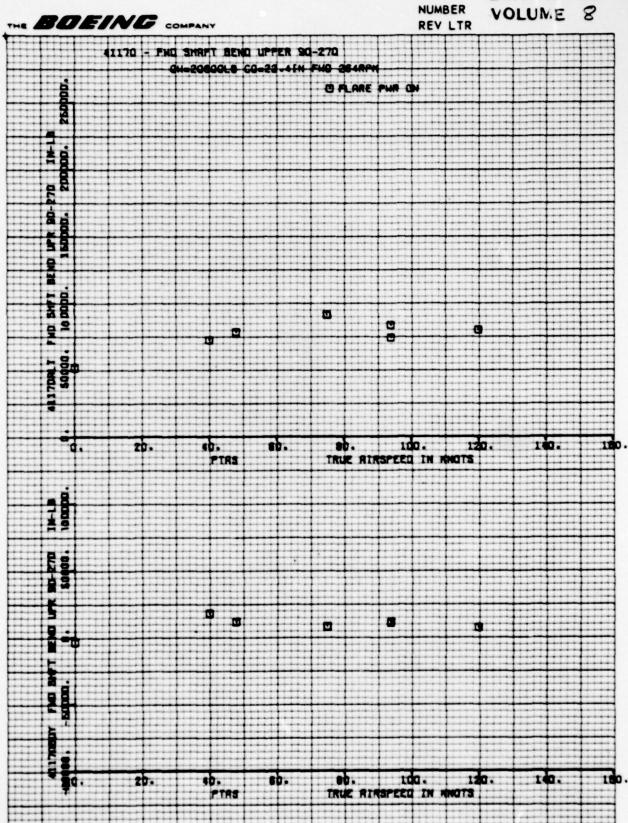
80.

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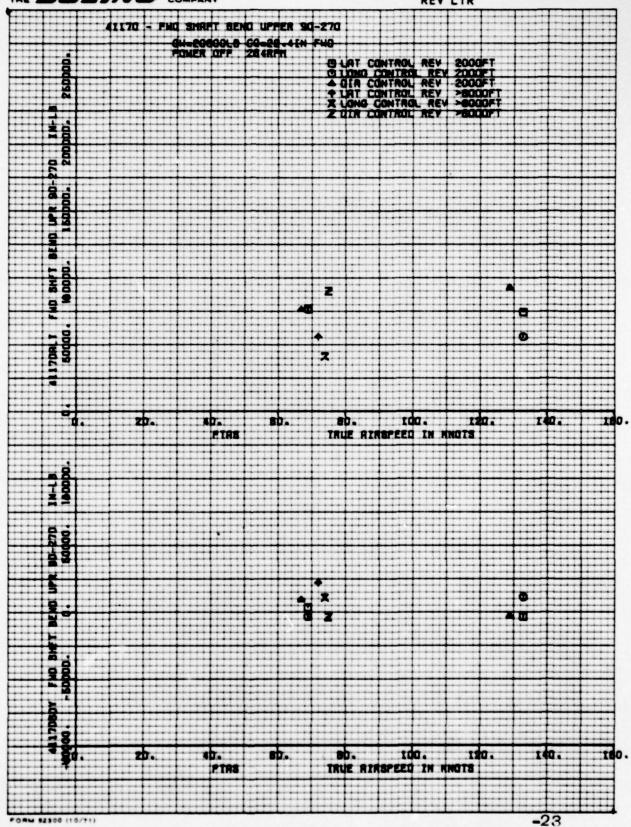
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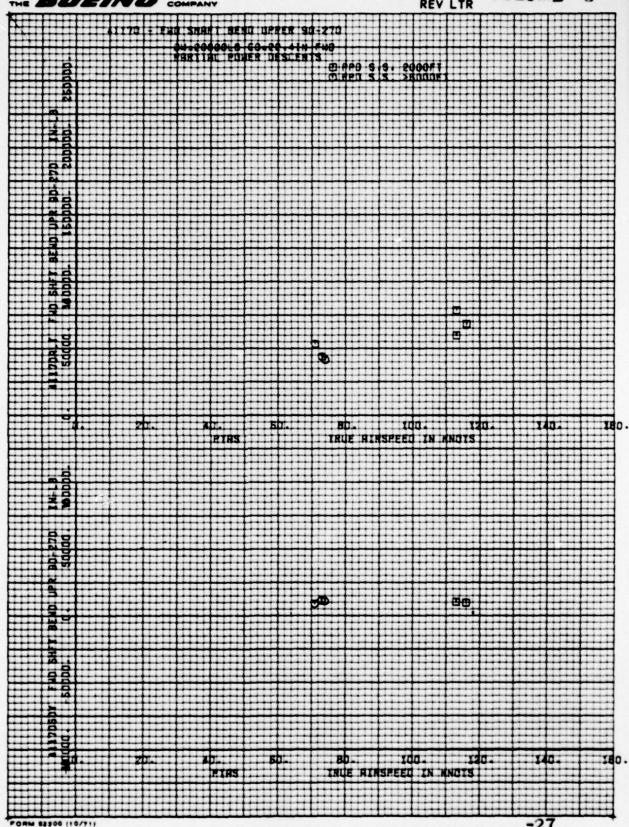
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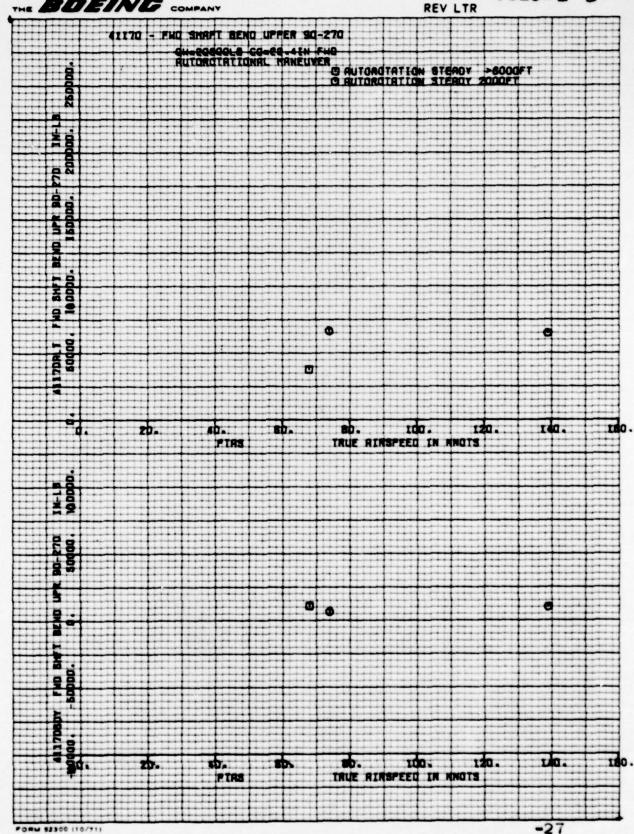
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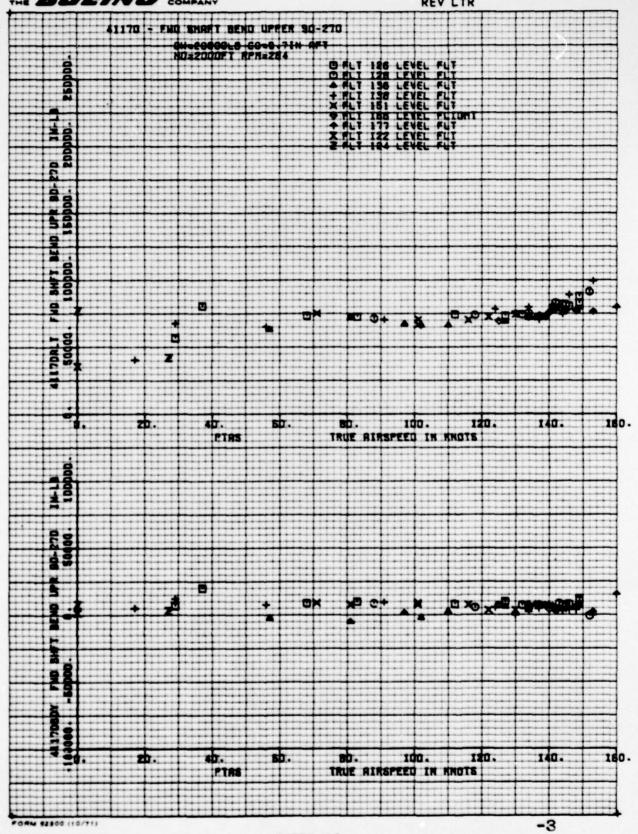
NUMBER REV LTR D210-11168-3

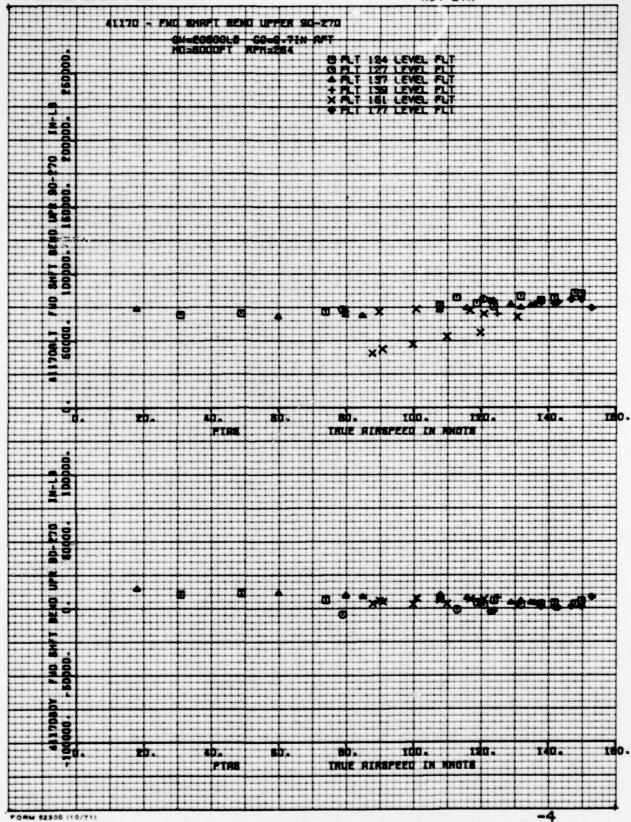


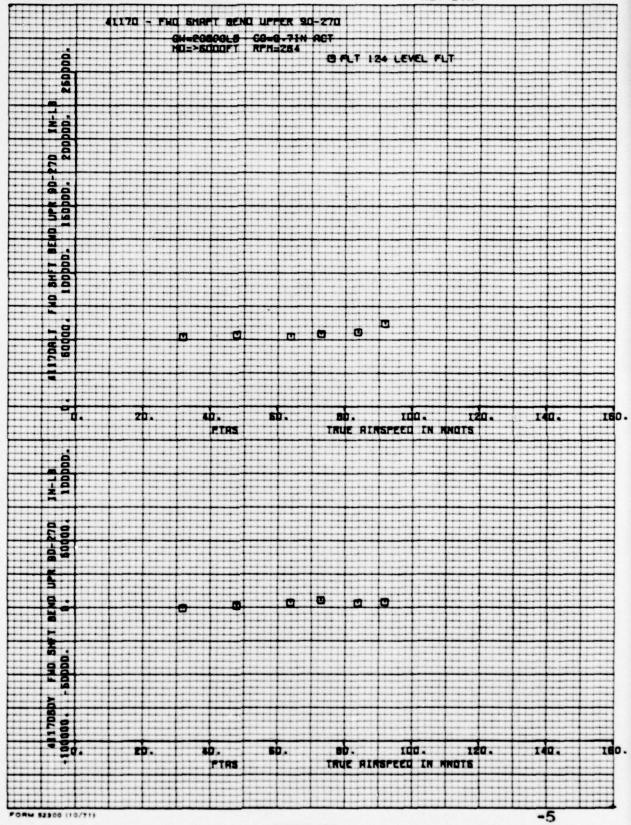
NUMBER VOLUME 8

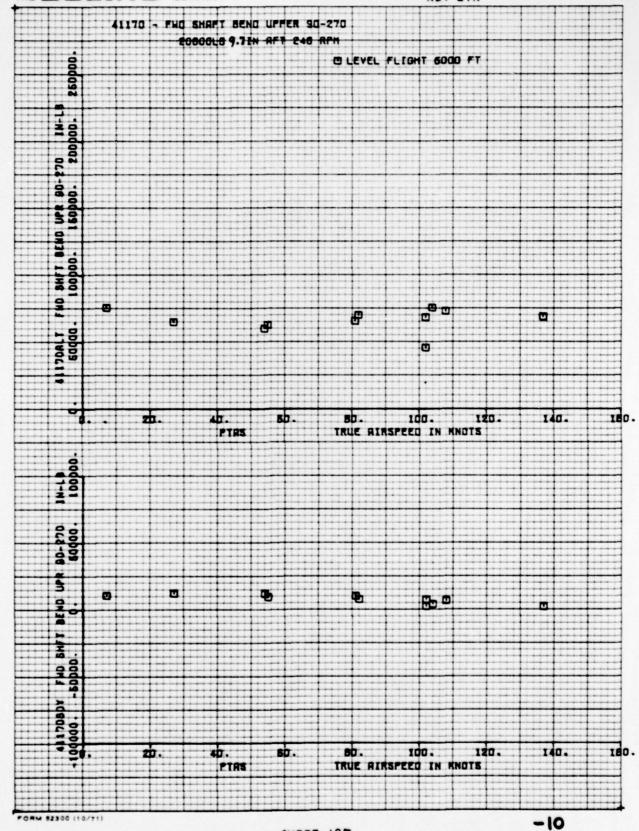


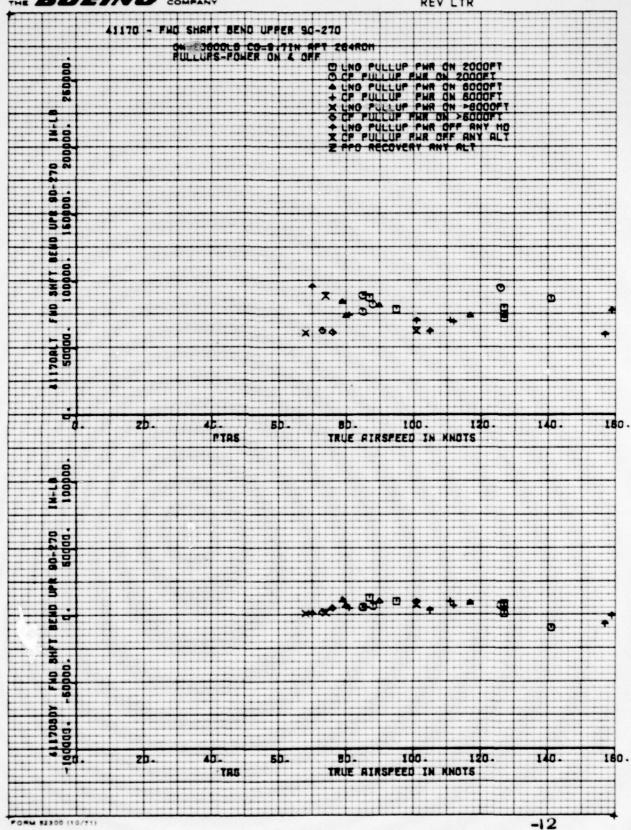
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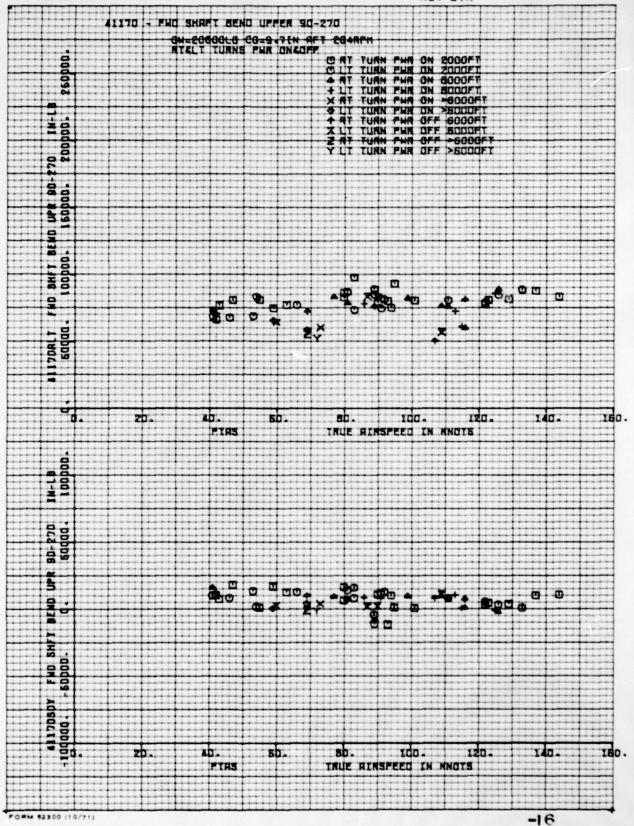


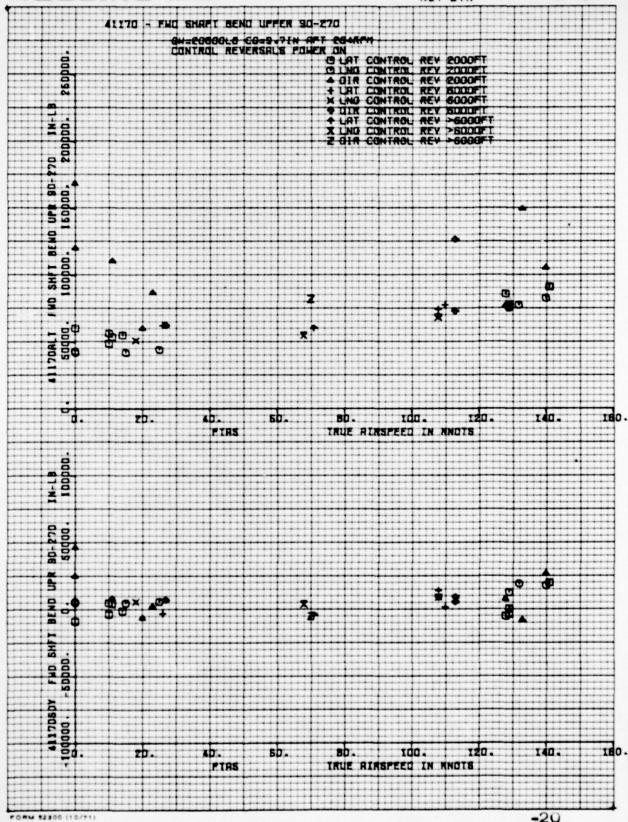


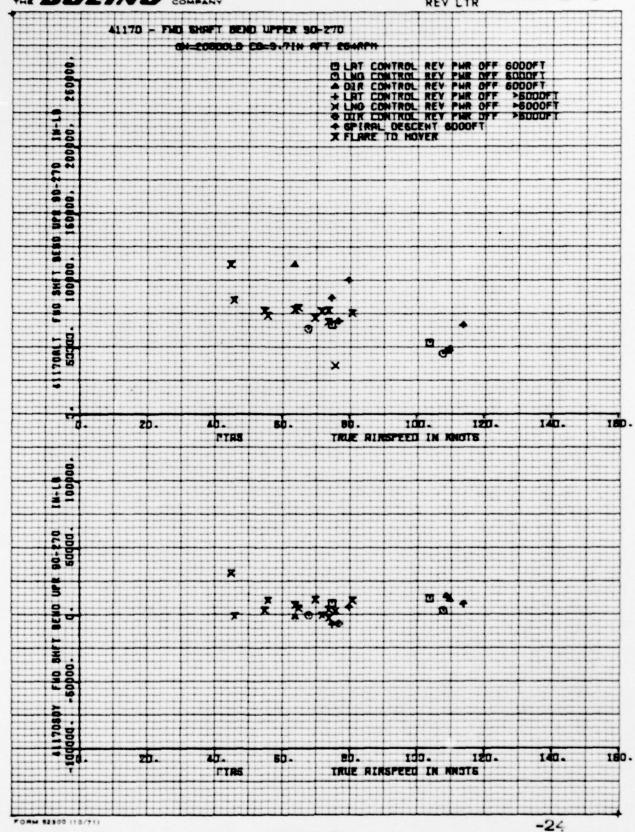






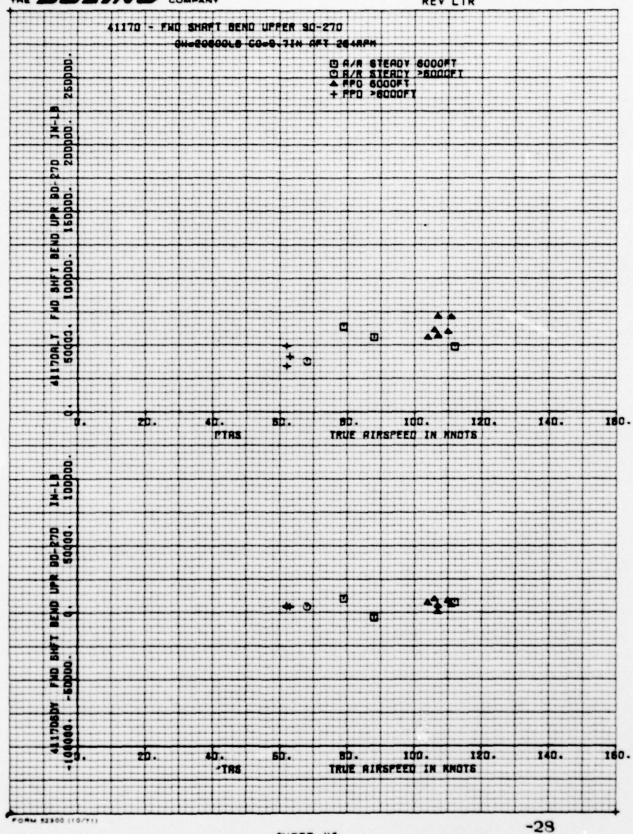




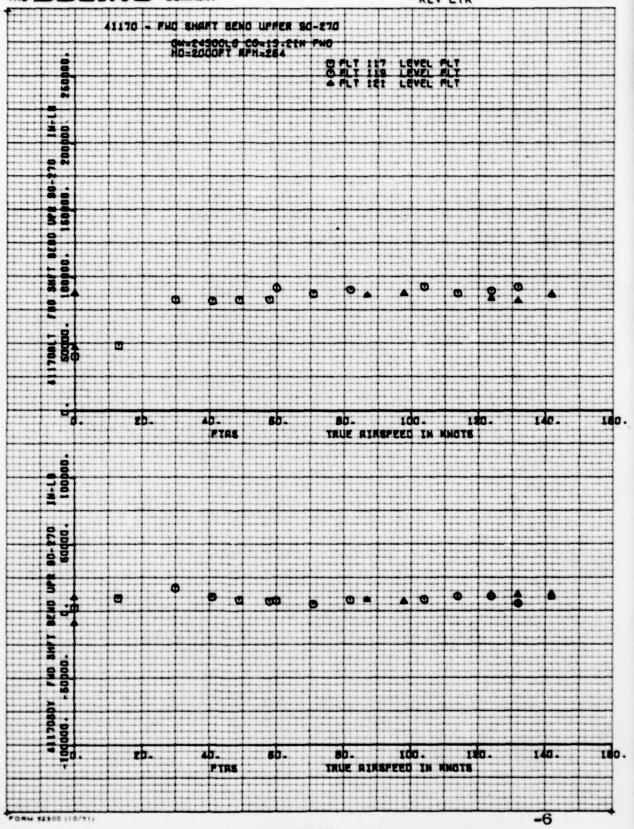


D210-11168-3





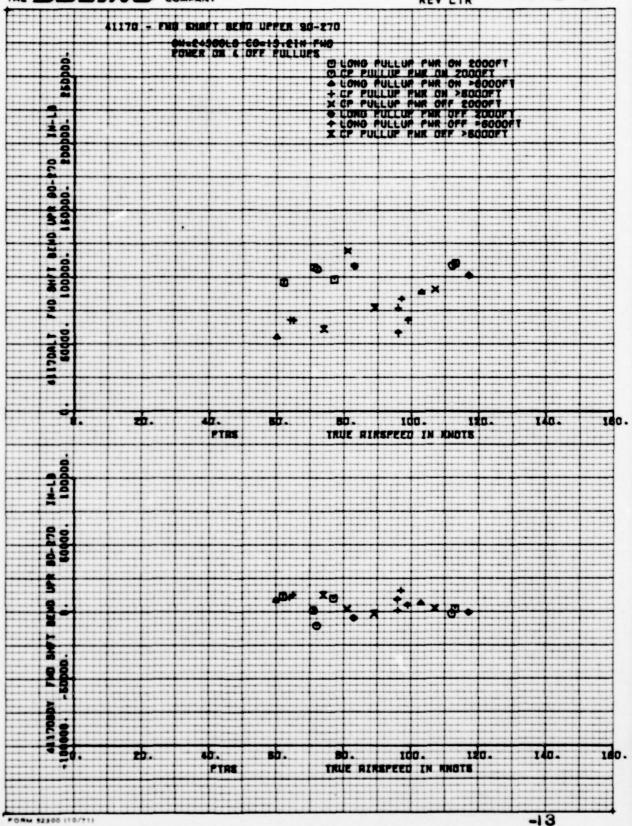


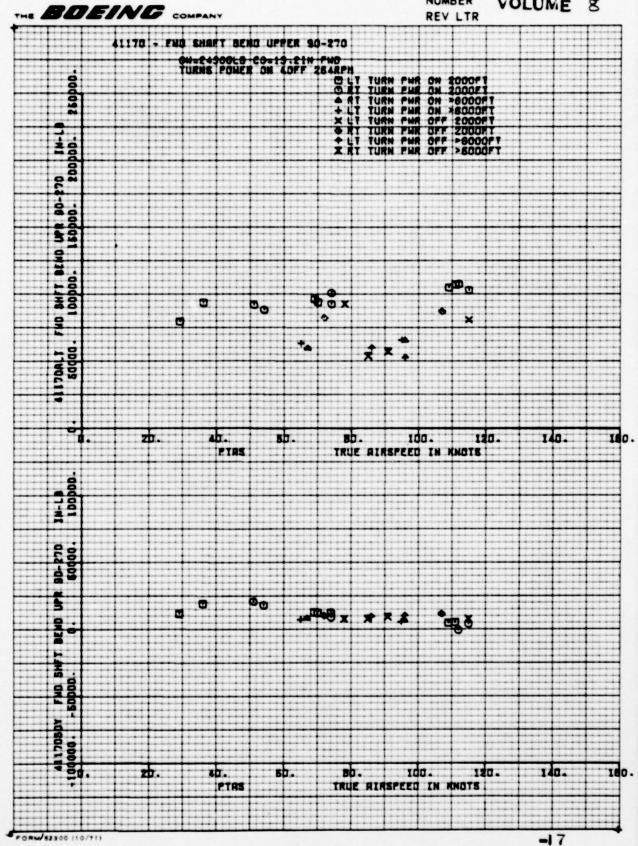


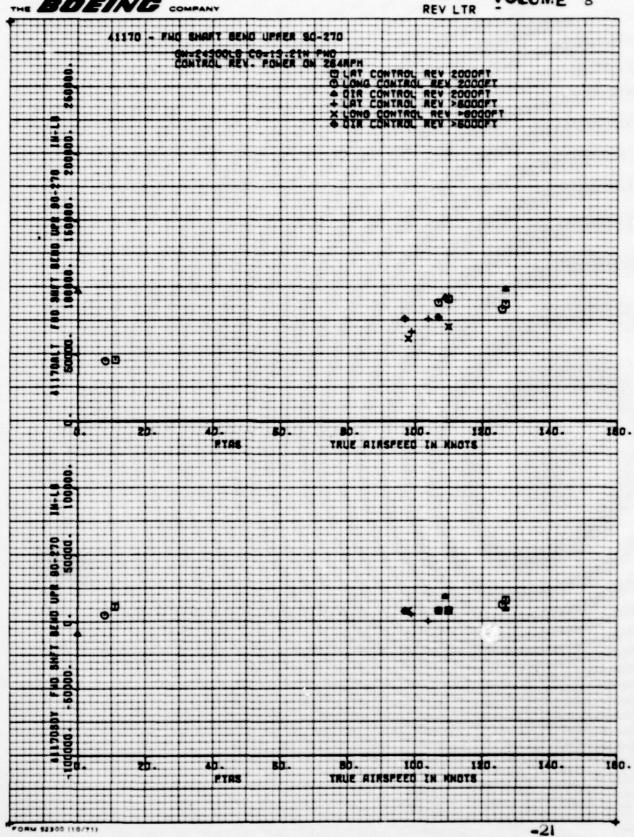
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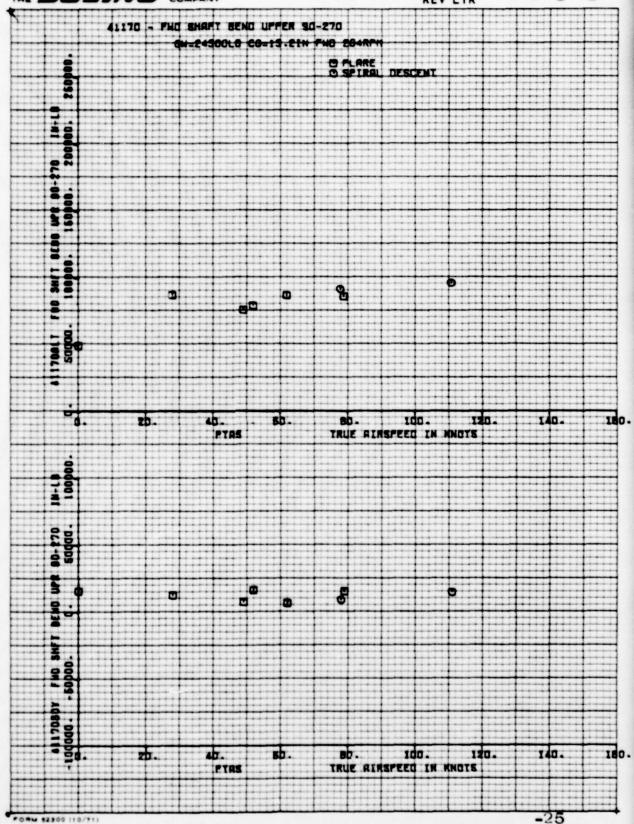
SHEET 112

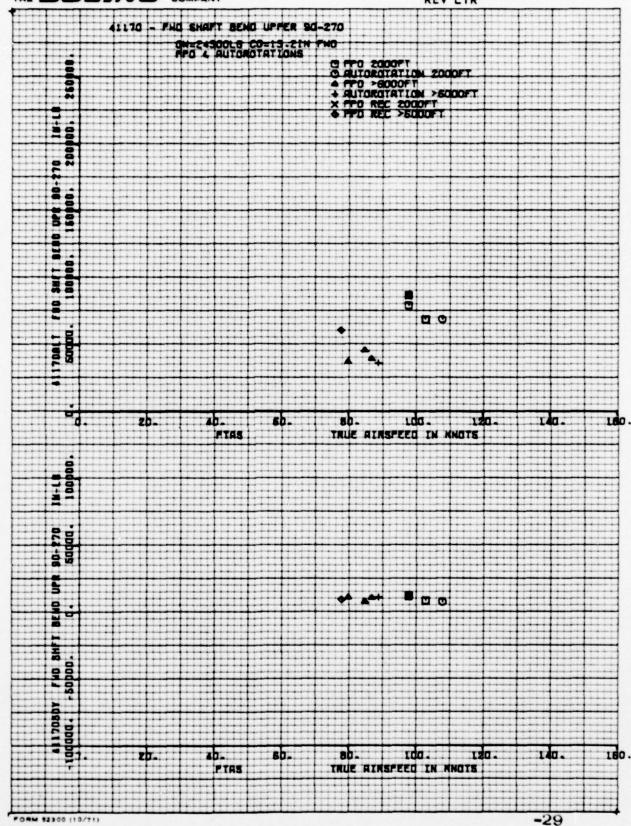
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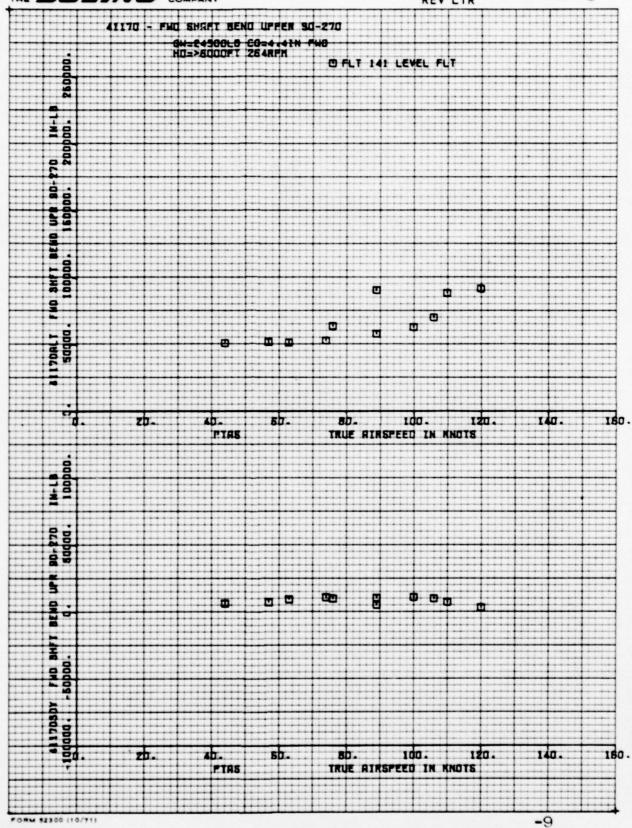
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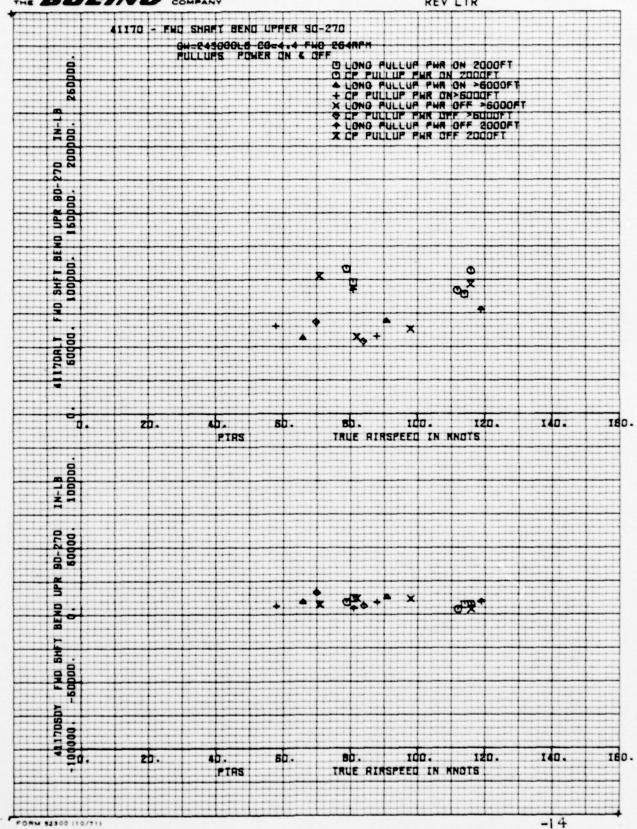
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THE BOEING COMPANY REV LTR 41170 - FHO SHRET BENO UPPER 90-270 00 24500L8 66-4.4[N FUB HD=2000FT RPH=284 OFLT 140 LEVEL FUT OFLT 141 LEVEL FUT A FLT 142 LEVEL FUT ZD. ab. 80. 100. 120. 140. 180 . FIRS TRUE RIRSPEED IN MNOTE .0. 100. 120. 8D. 80. 140. IBO. TRUE RINSPEED IN MNOTS PTAS

TORM \$2300 (10/71)

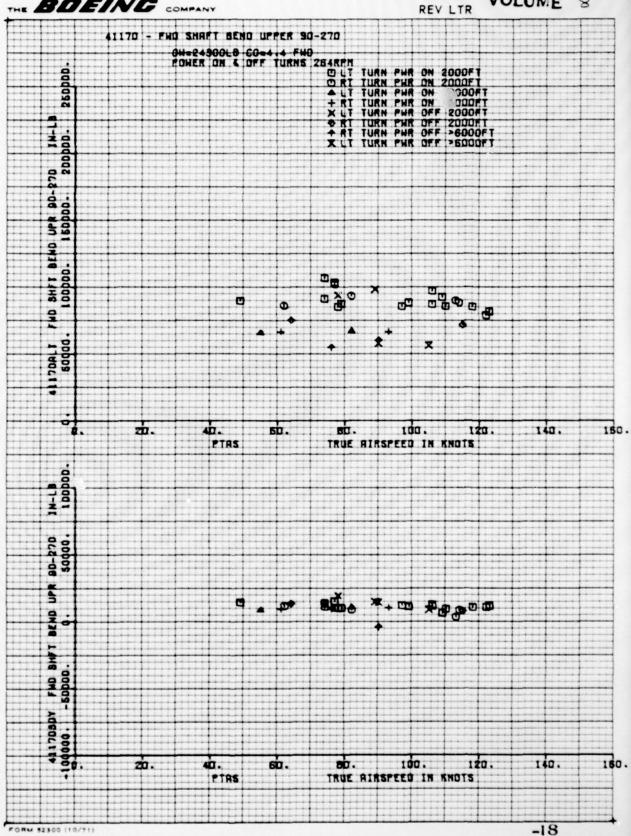
THE BOEING COMPANY

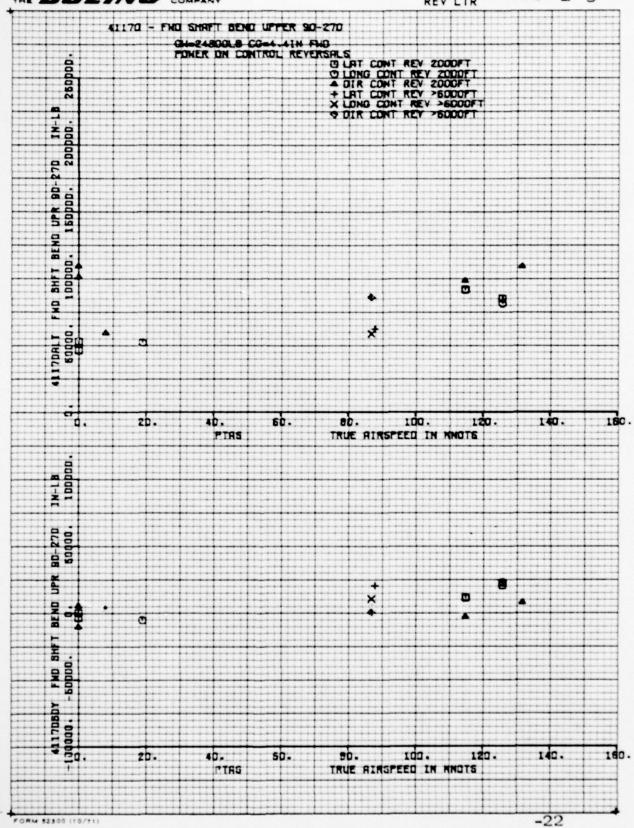


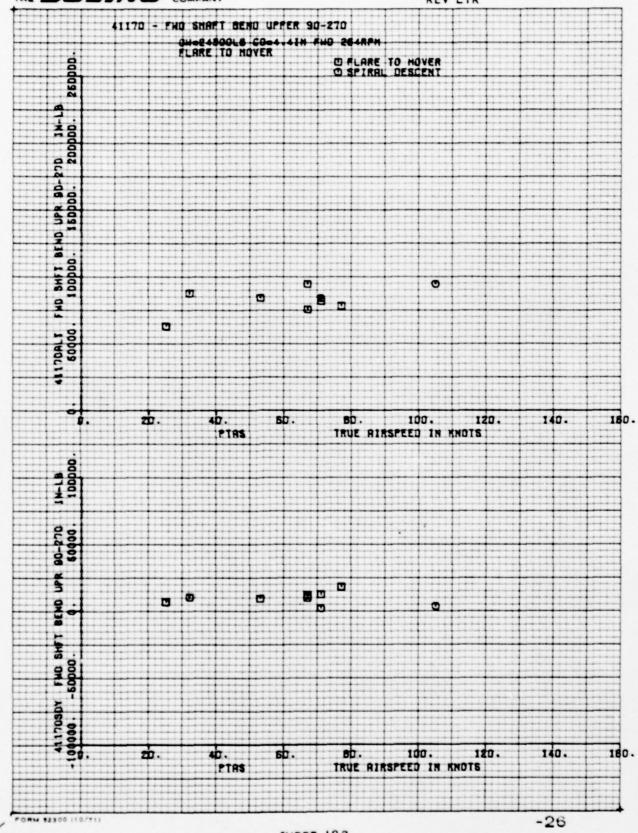


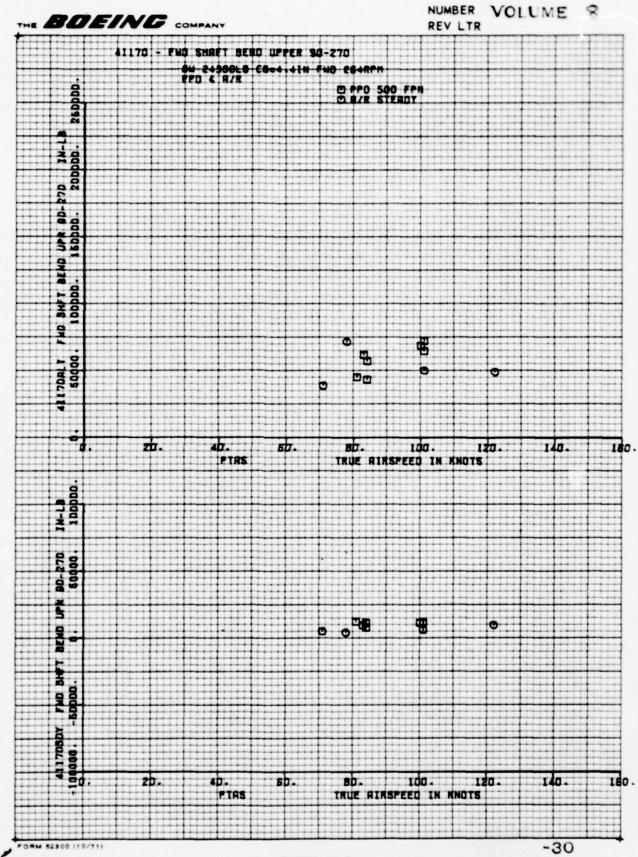
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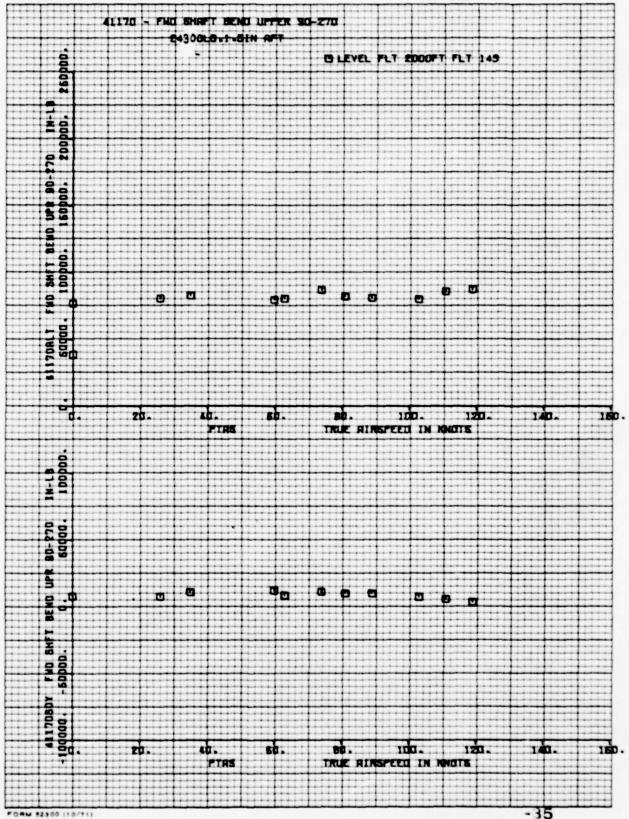
THE BOEING COMPANY











PREPARED BY: J. Bendo

NUMBER D210-11168-3 REV LTR Volume 8

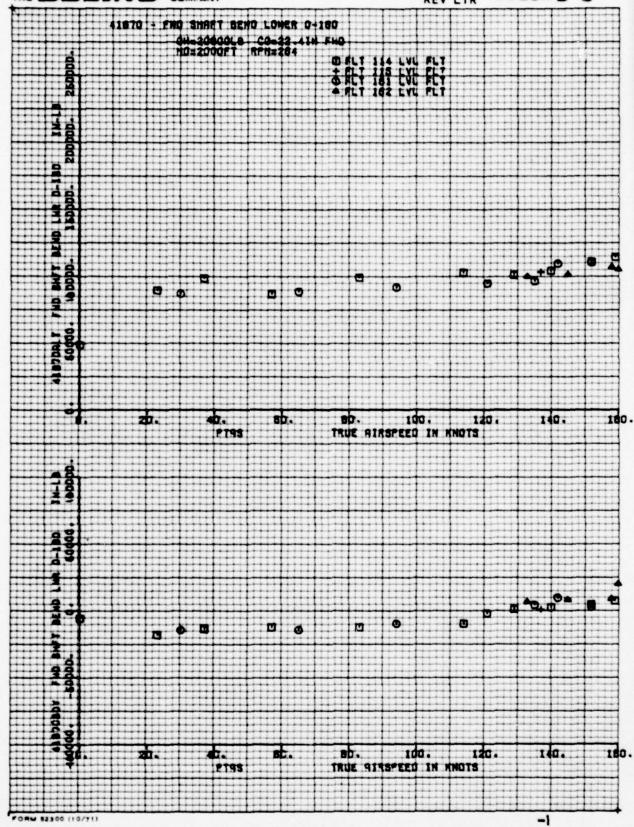
MODEL NO.

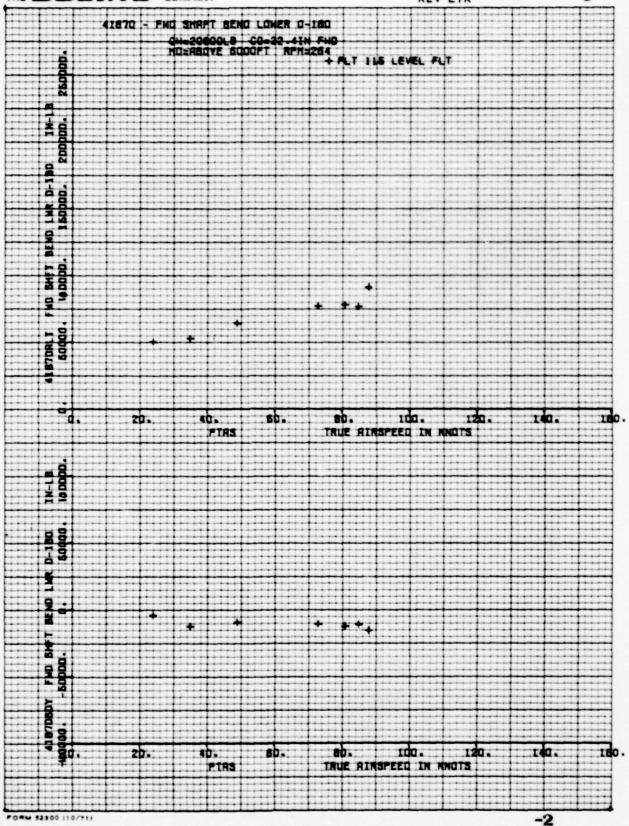
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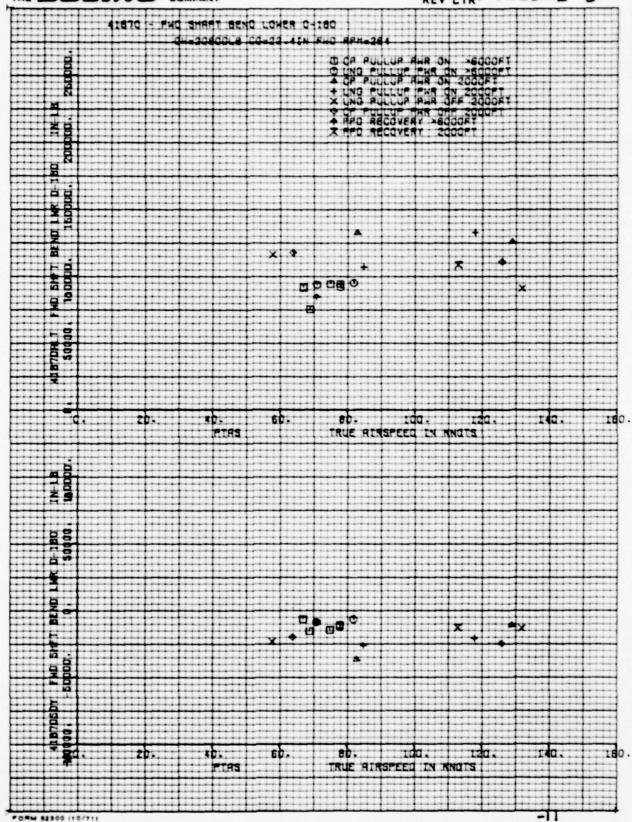
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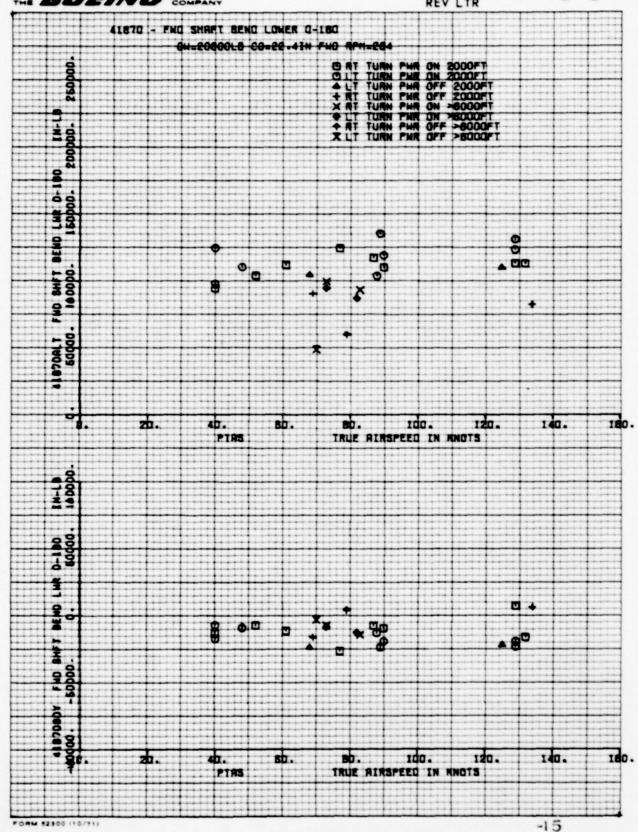
8/28/78

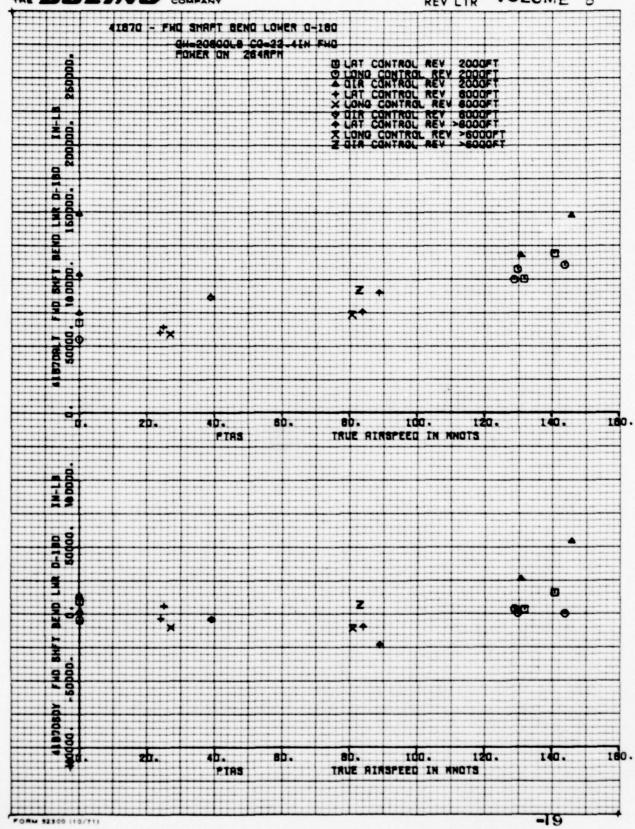
4.4 Forward Shaft Bending, Lower (0° - 180°)

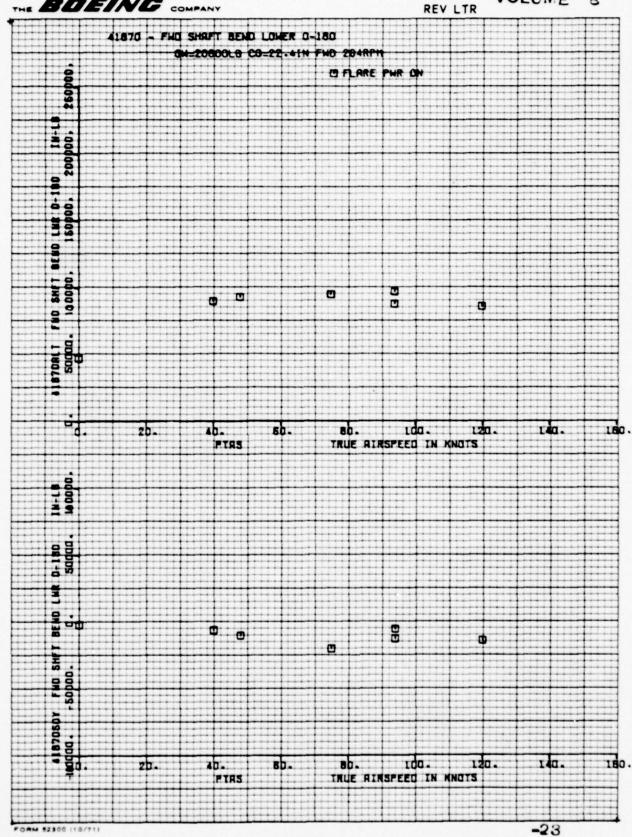


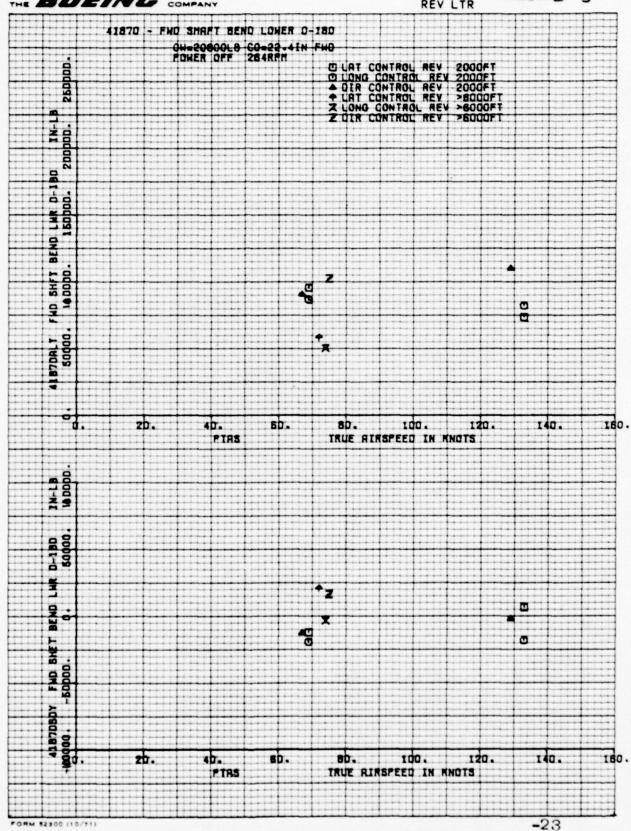












NUMBER F VOLUME 8

THE BOEING COMPANY REV LTR ID SHAFT BENU LUNER CHI-20000LB CO-22.4IN FHD RUTOROTATION STEADY >6000FT CO RUTOROTATION STEADY >6000FT CO RUTOROTATION STEADY 2000FT 41870 - FHO SHRFT BEND LOHER 0-180 260000. FNO SHET BENO LWR 0-180 0 140. 150. zb. 40-50. 80. 100. PTAS TRUE RIRSPEED IN MNOTS 0-180 Sadoa. 0 Y FWD SHFT : 0 40. БЬ. 100. 120. 140. IBC zb.

SHEET 135

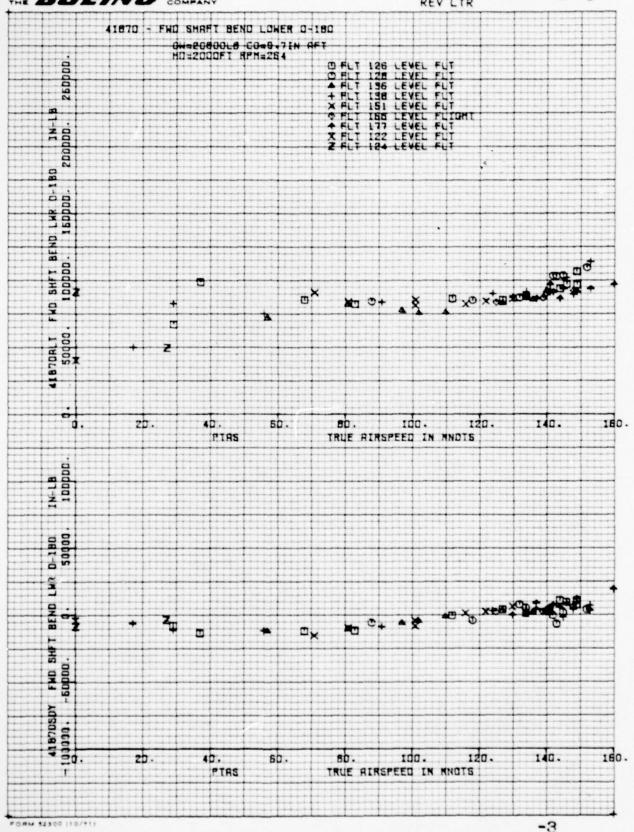
TRUE AIRSPEED IN KNOTS

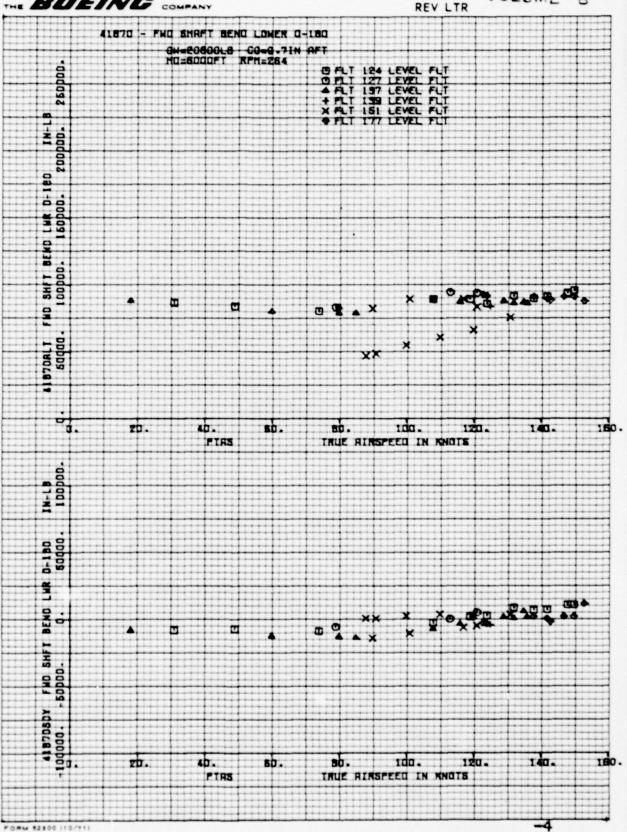
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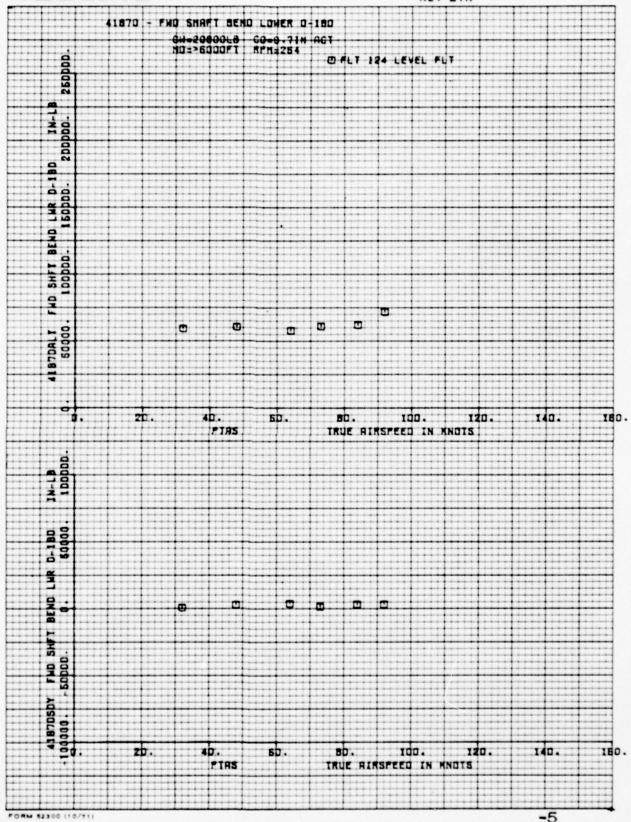
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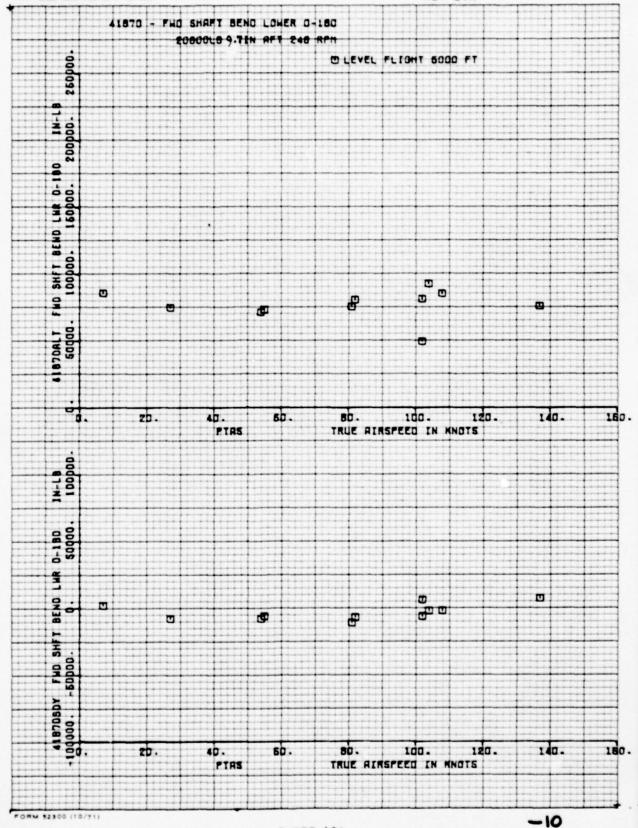
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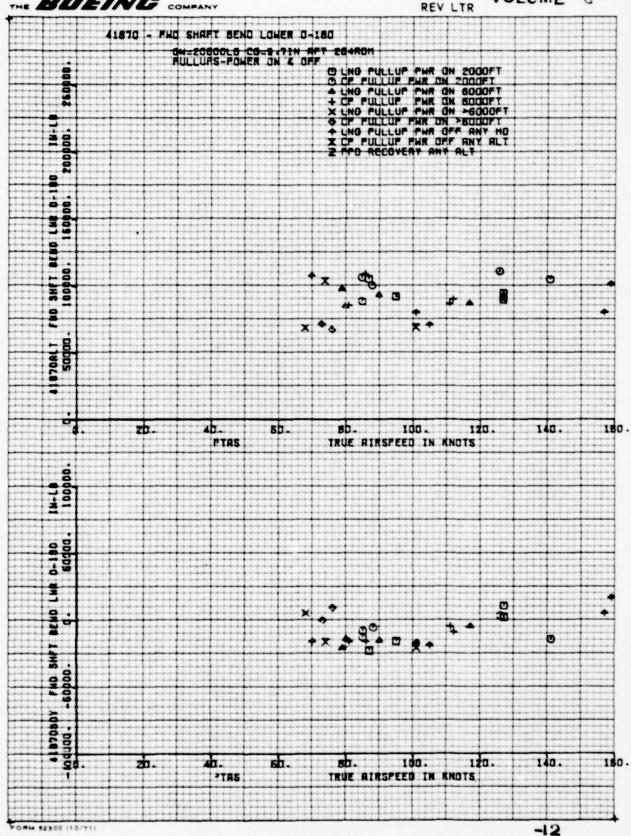
FORM \$2300 (10/71)

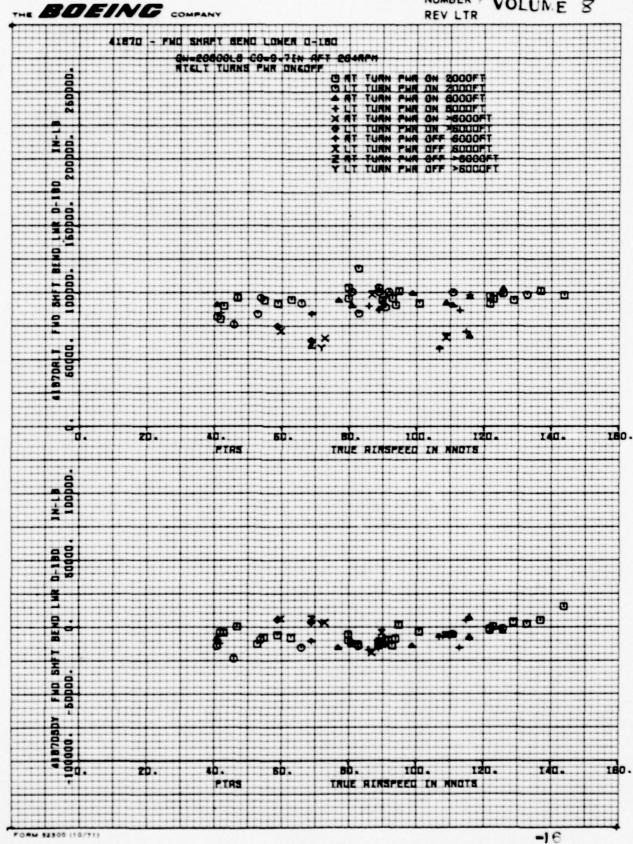


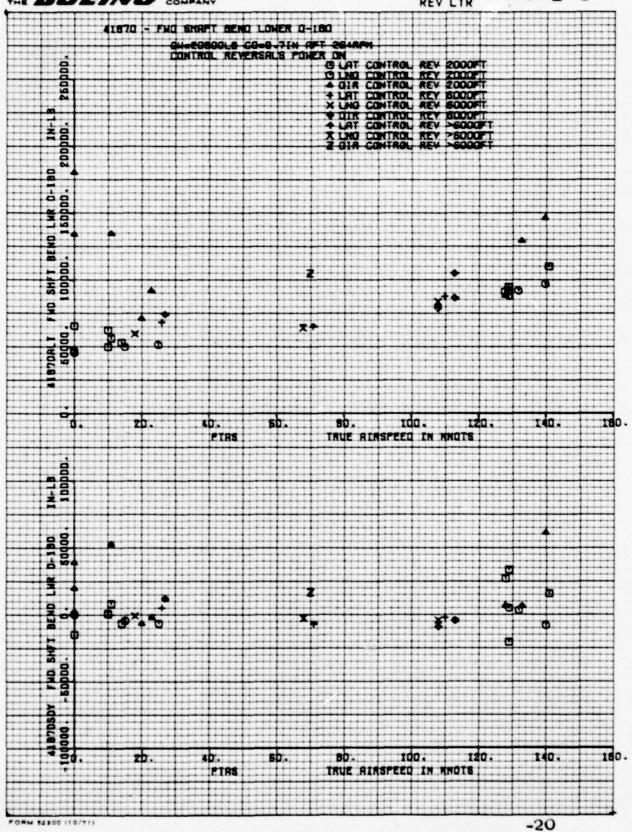


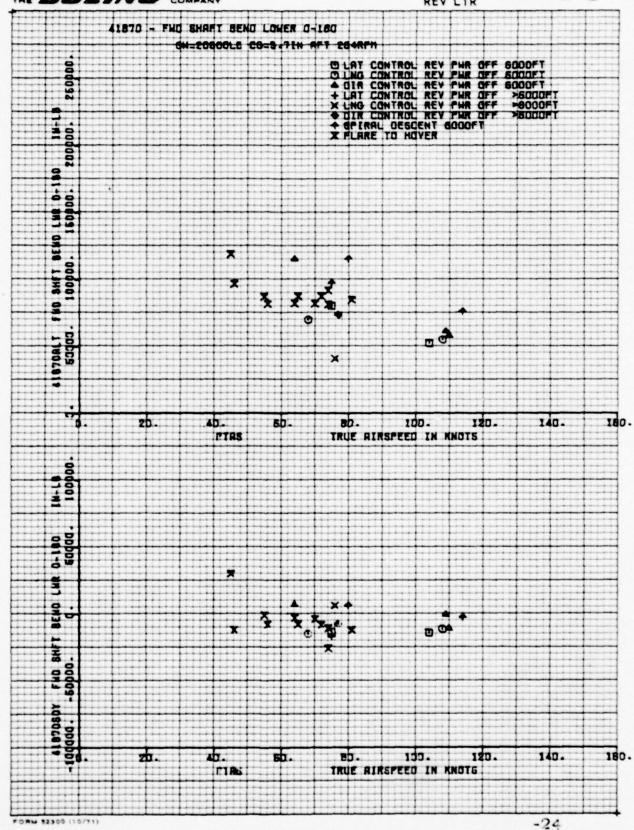




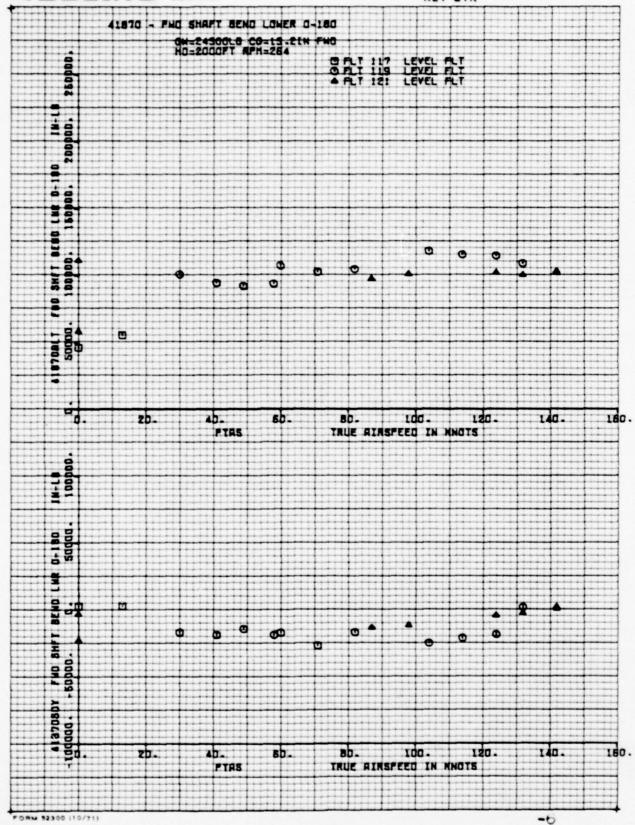


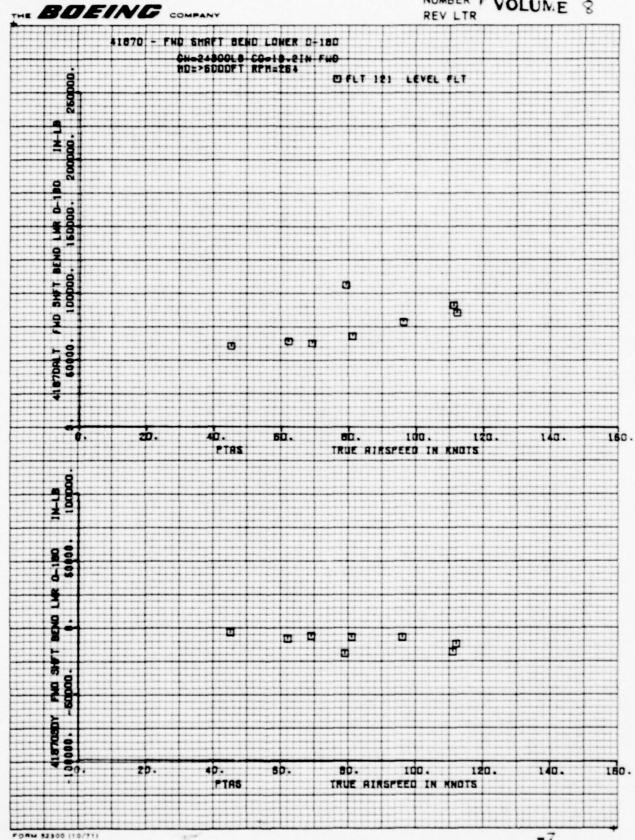




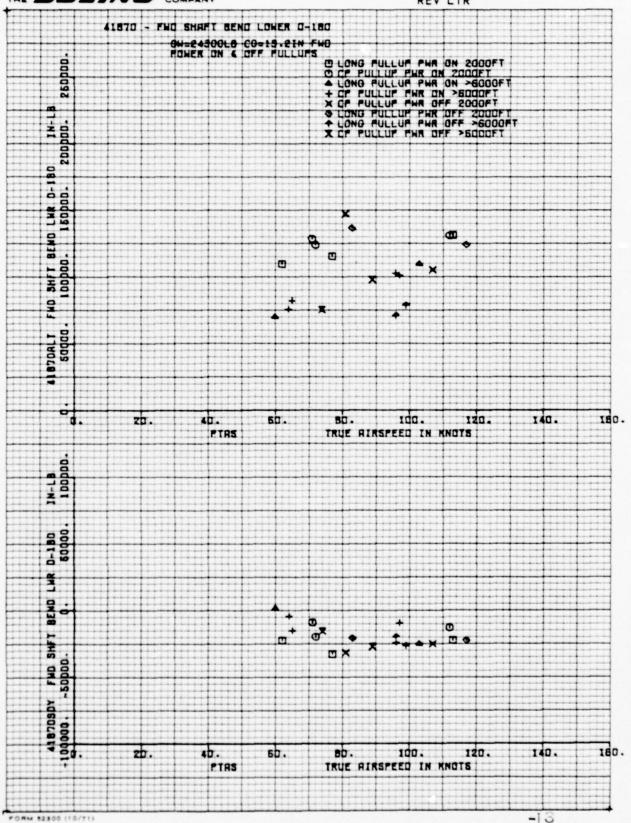


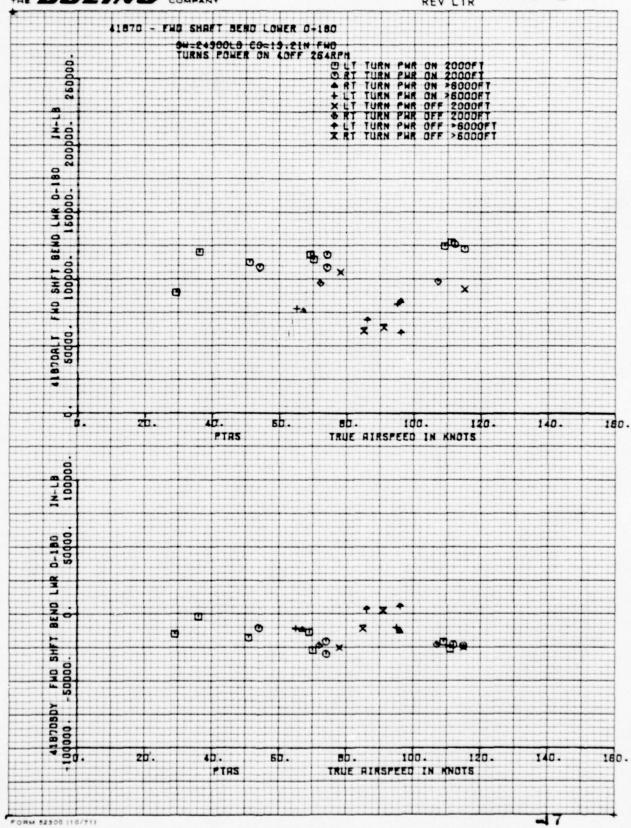
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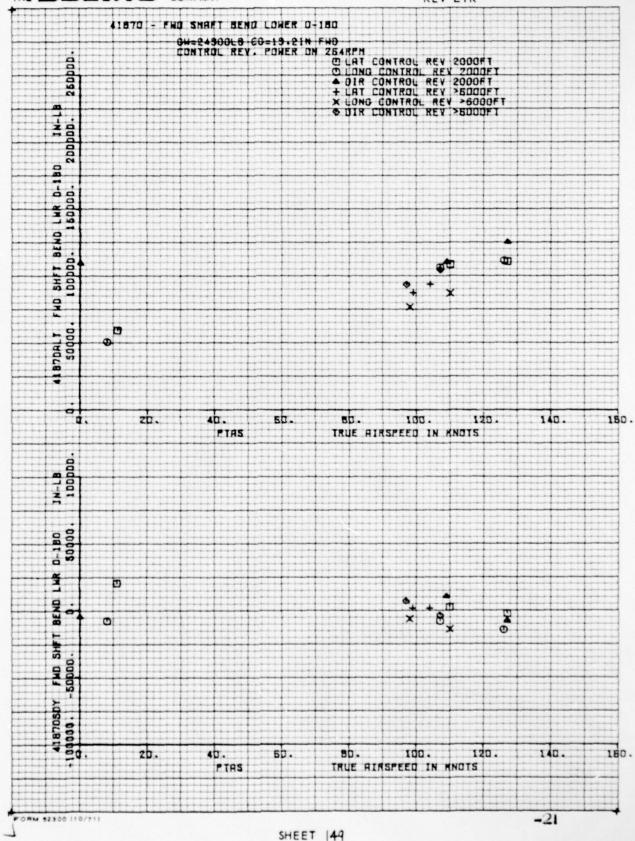




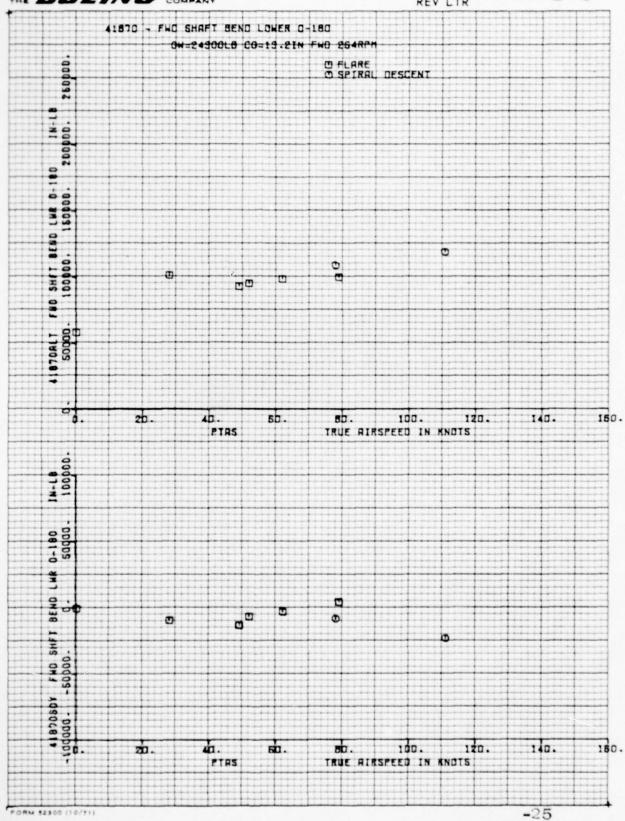
NUMBER | VOLUME 8 REV LTR

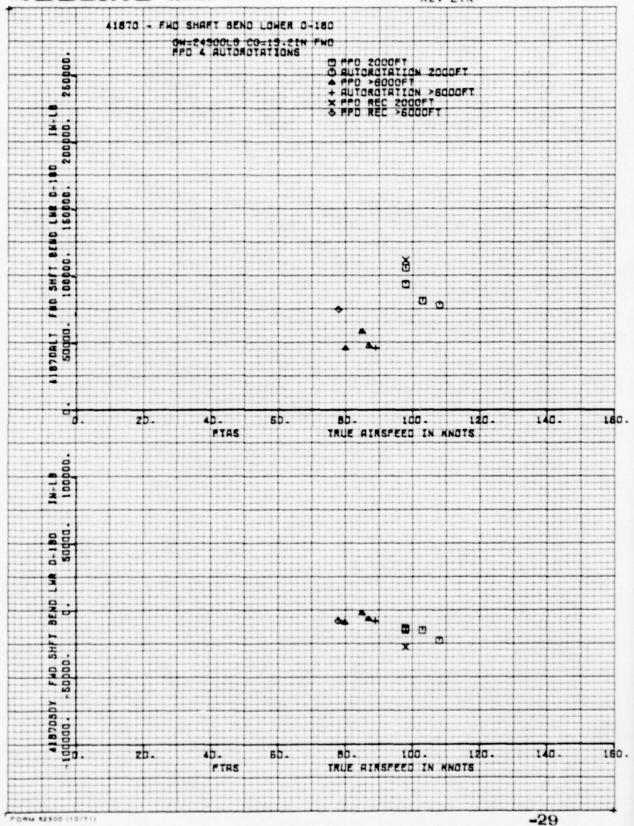


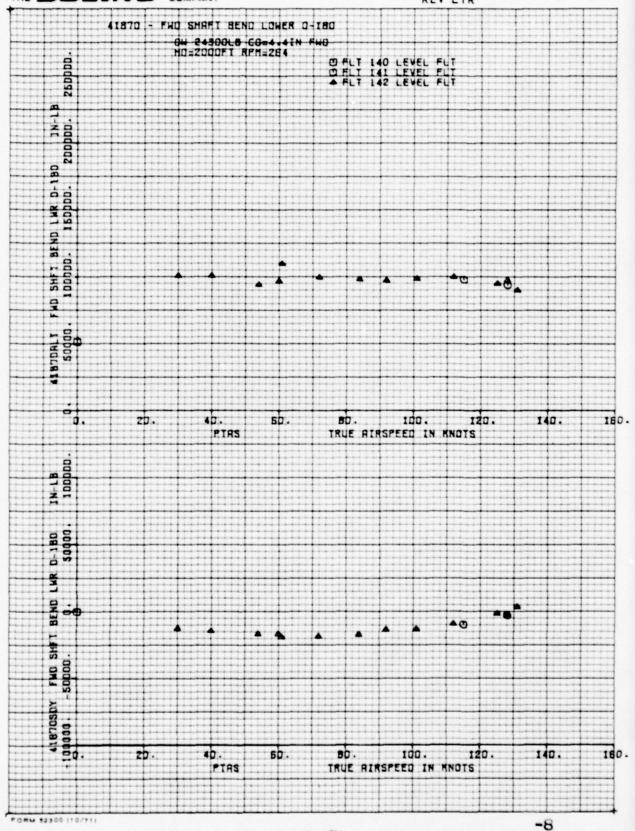




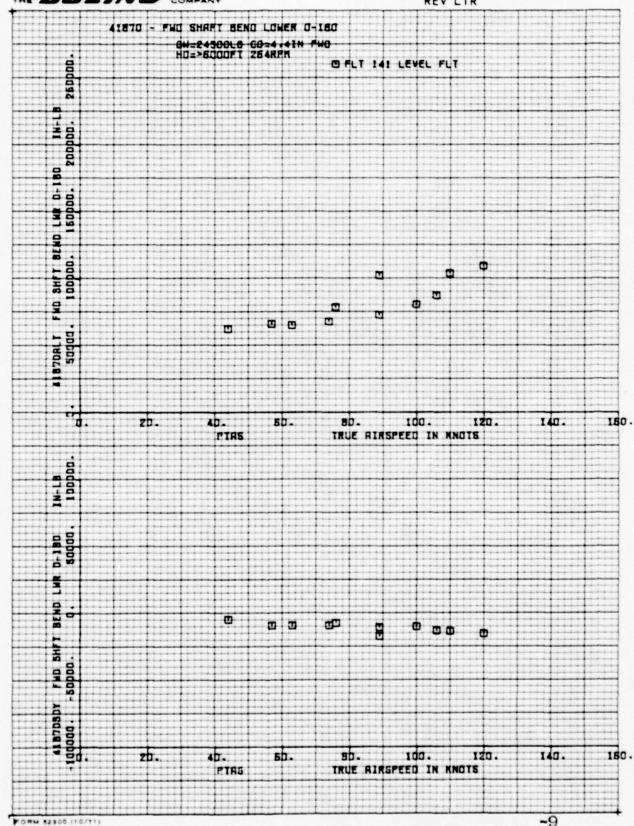
NUMBER F VOLUME 8

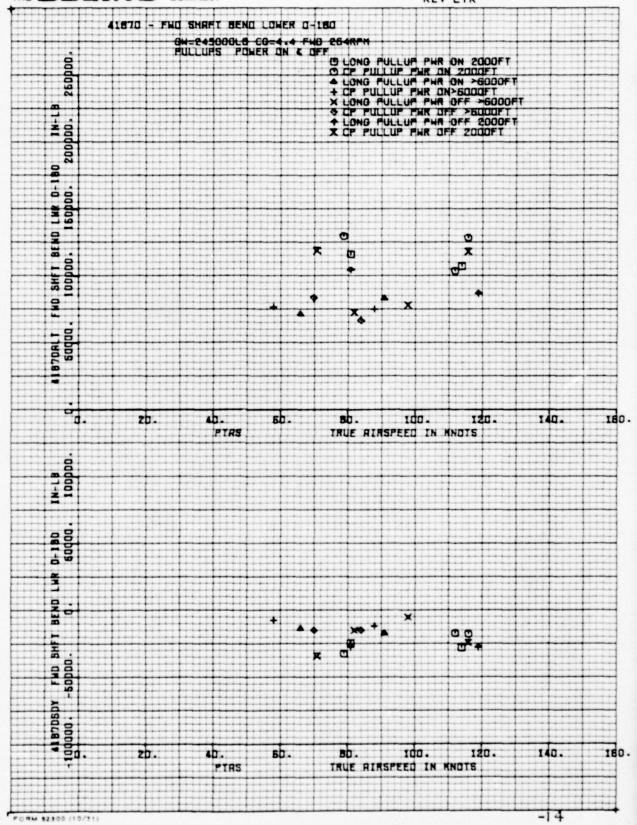


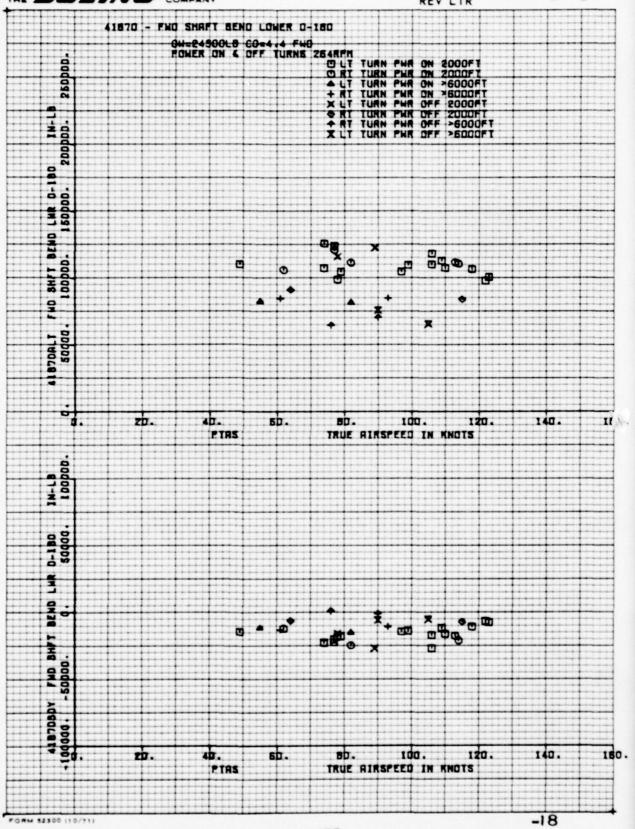


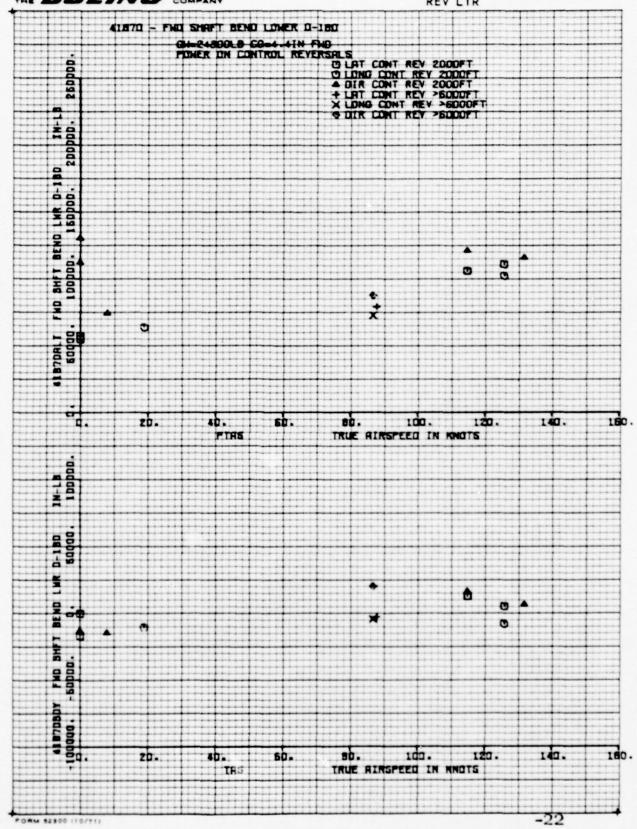


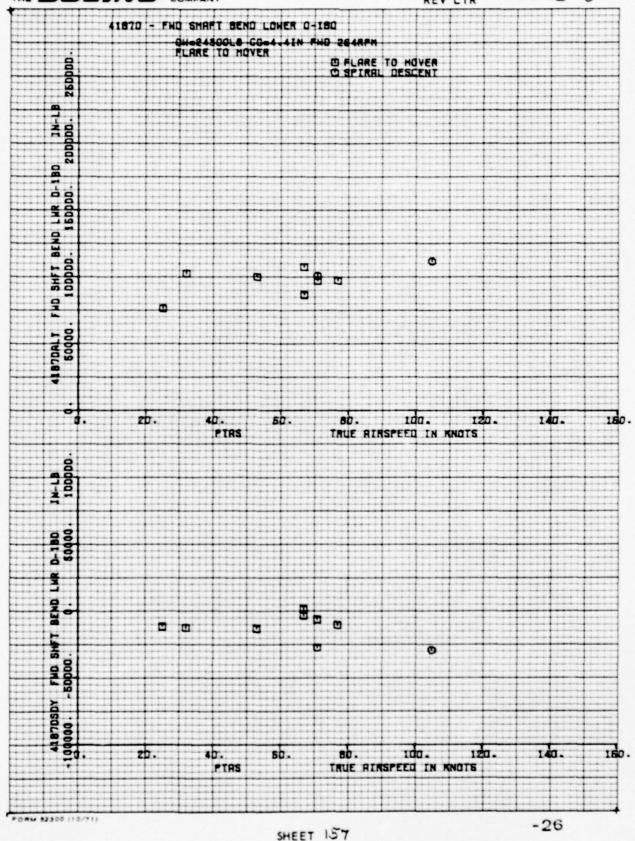
D210-11168-3 NUMBER VOLUME 8











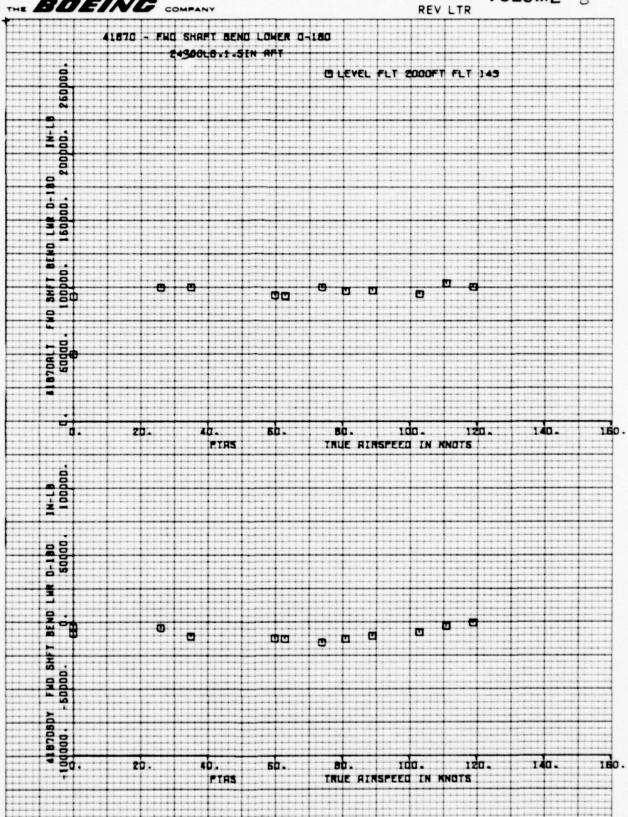
NUMBER VOLUME 8

THE BOEING COMPANY REV LTR \$1870 - FWO SHRET BEND LOWER 0-180 EH 24500LE CO-4.4[N FHD 264RPM E PPO SOO FPE 偶 0 0 D 0 DO 0 4D. BD. 100. 140. 20. BD. 120. 160. TRUE RIRSPEED IN ANDTS PTRS 80 . 100. 140. 160. 40. FTAS TRUE RIRSPEED IN MNOTE

FORM \$2300 (10/71)

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FORM \$2300 (10/71)



PREPARED BY: J. Bendo

NUMBER D210-11168-3 REVLTR Volume 8

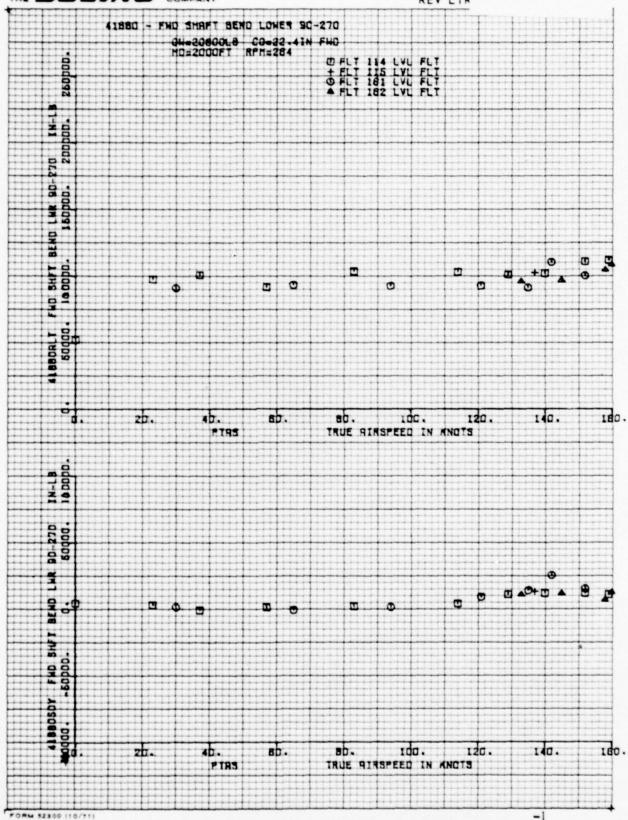
MODEL NO.

THE BOEING COMPANY DATE:

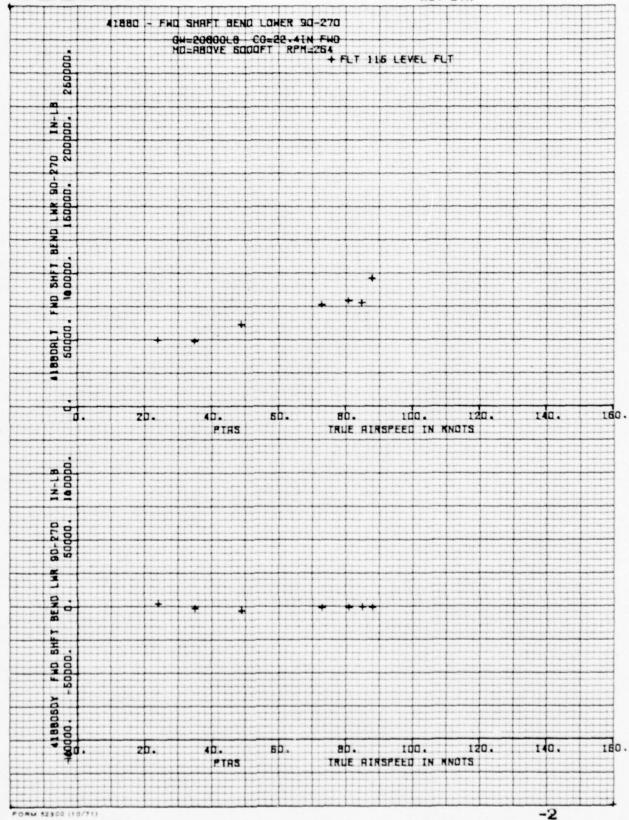
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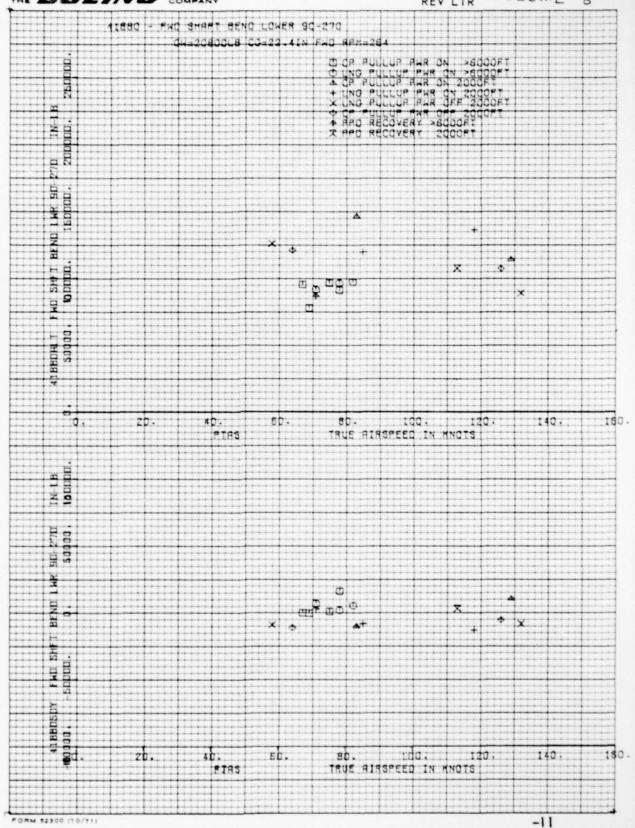
8/28/78

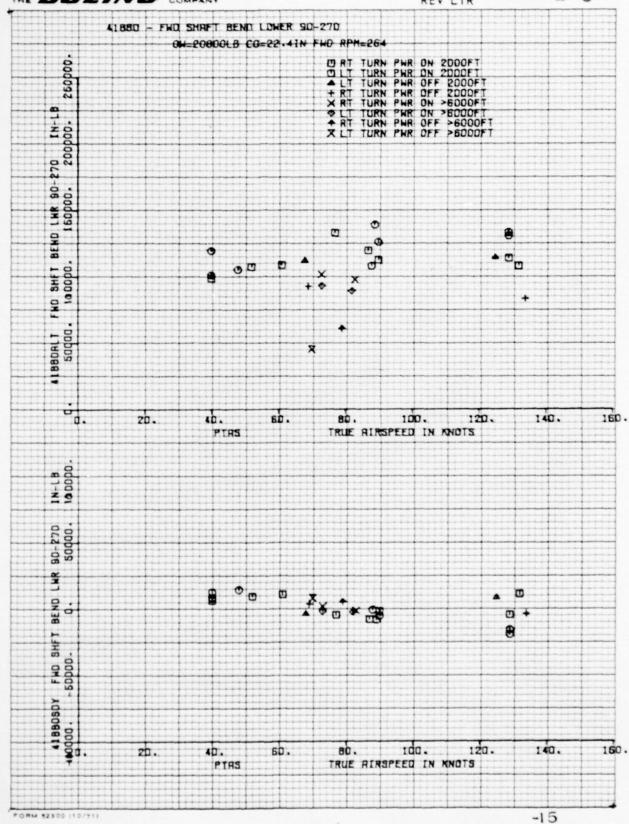
4.5 Forward Shaft Bending, Lower (90° - 270°)

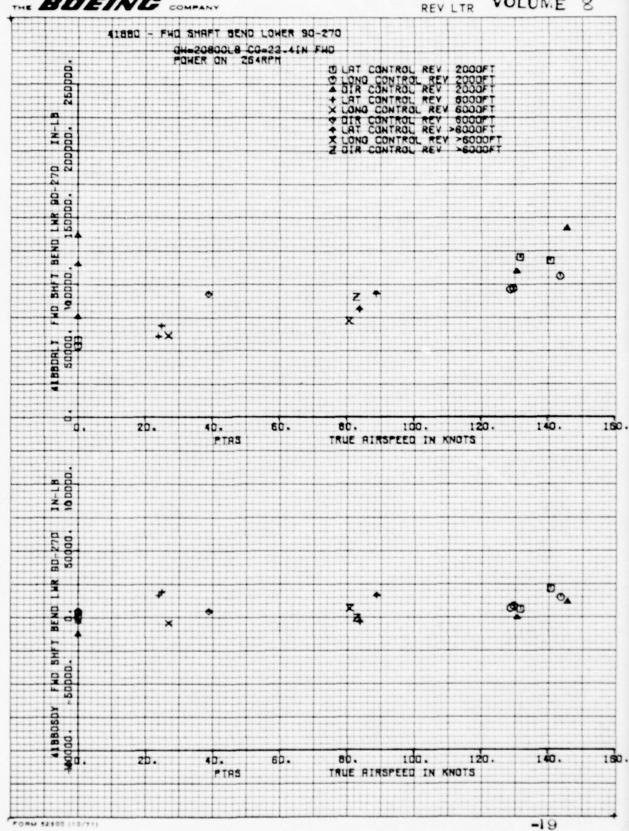


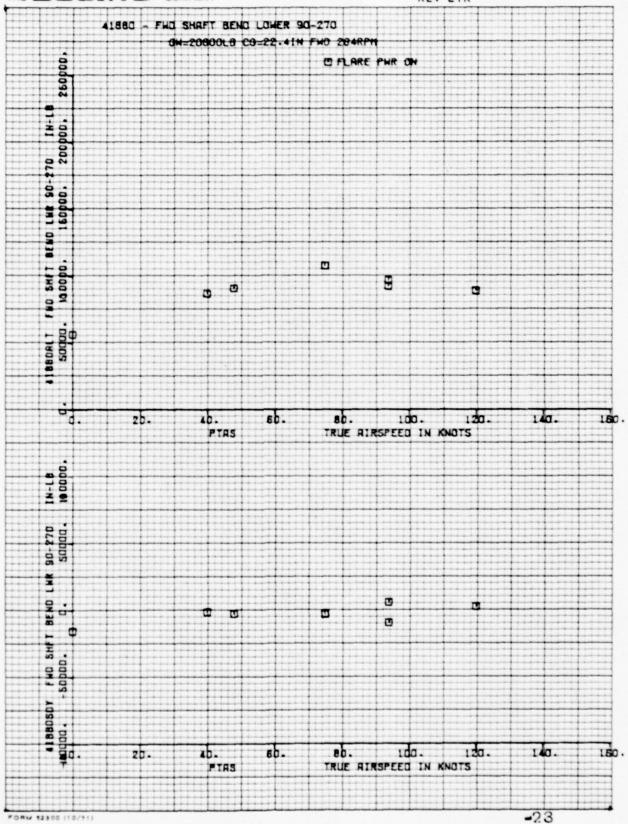
VOLUME 8 NUMBER REV LTR

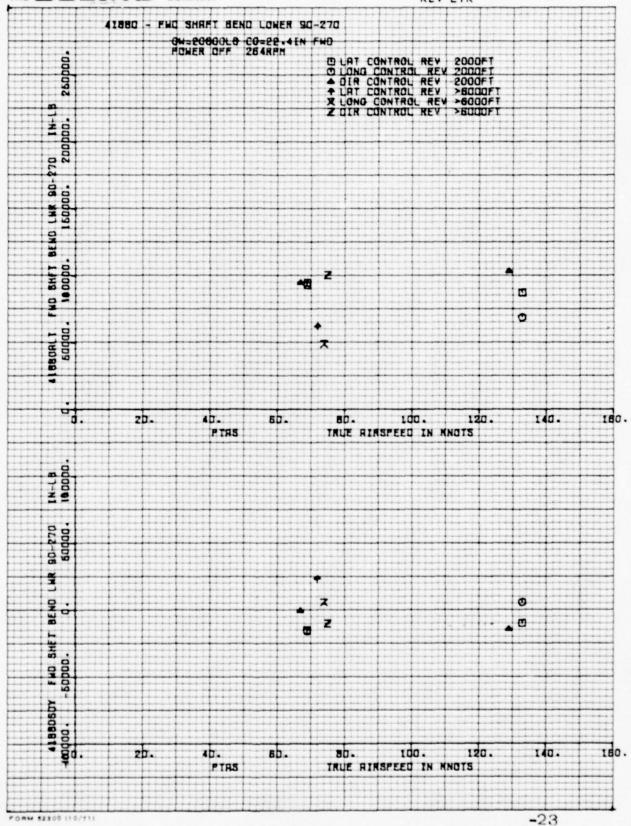


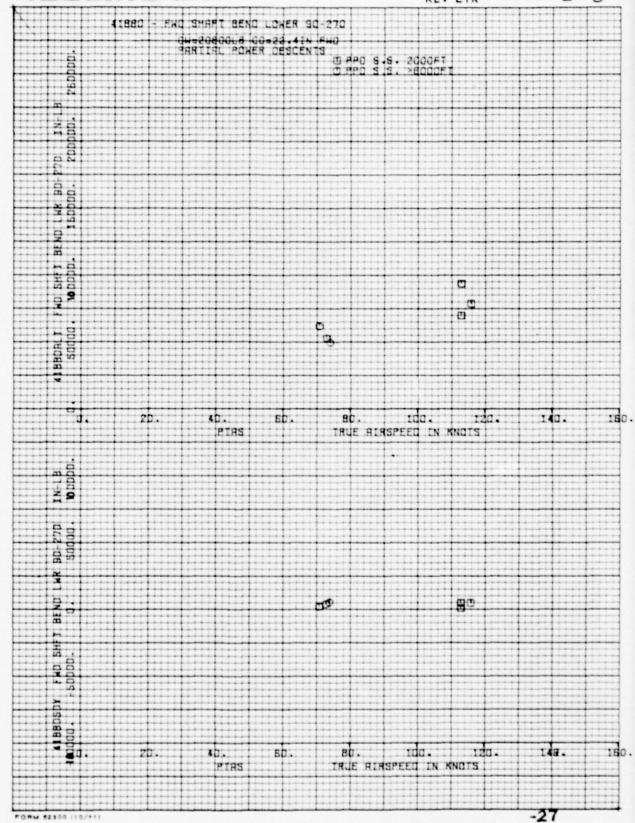


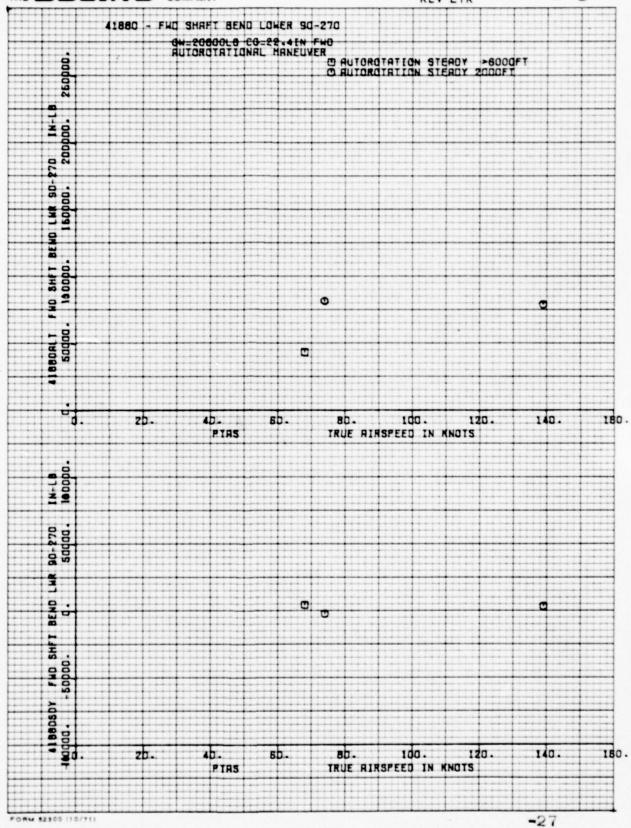


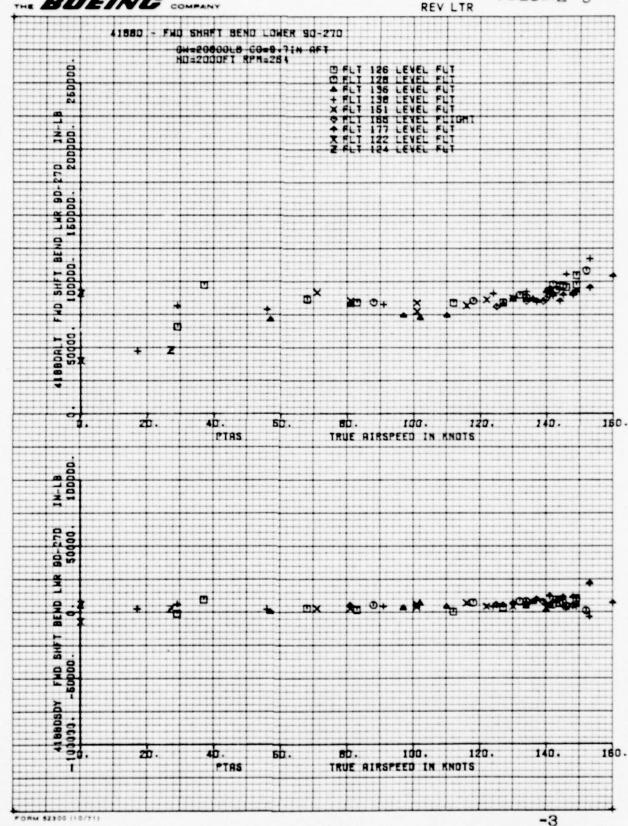


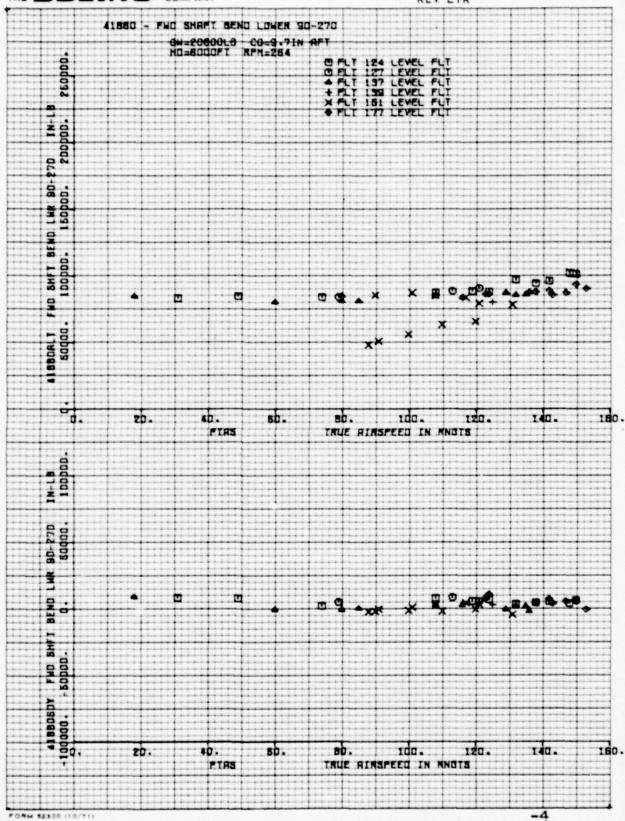


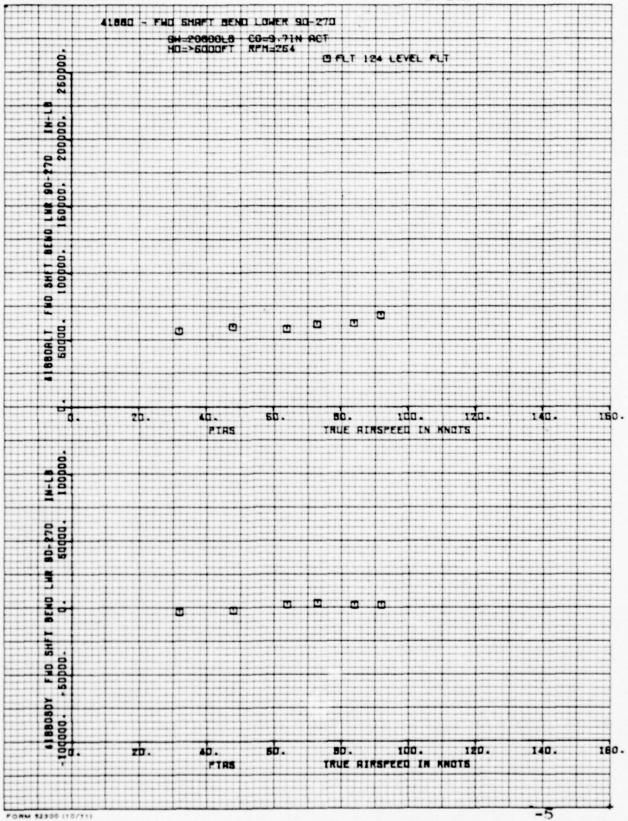












D210-11168-3 NUMBER REV LTR VOLUME 8

THE BOEING COMPANY

41880 - FHO SHRET BEND LOHER 90-270 20000LB 9.71N AFT 240 RPM 260000 D LEVEL FLIGHT 6000 FT 8 8 8 U 40. 140. 20. 50. 100. IED. 80. PTRS TRUE RIRSPEED IN KNOTS 0 0 90 140. 80. 100. 180. 20. 40. 60. PTRS TRUE RIRSPEED IN KNOTS FORM \$2300 (10/71) -10

NUMBER VOLUME 8

THE BOEING COMPANY REV LTR 41880 - FWO SHAFT BEND LOWER 90-270 CH-20600LB CO-9 71N GFT 264ROM PULLUPS-POHER ON 4 DFF © LNO PULLUP PHR ON 2000FT

OF PULLUP PHR ON 2000FT

LNO PULLUP PHR ON SOCOFT

X LNO PULLUP PHR ON SOCOFT

CP PULLUP PHR ON SOCOFT

LNO PULLUP PHR OF ANY HO

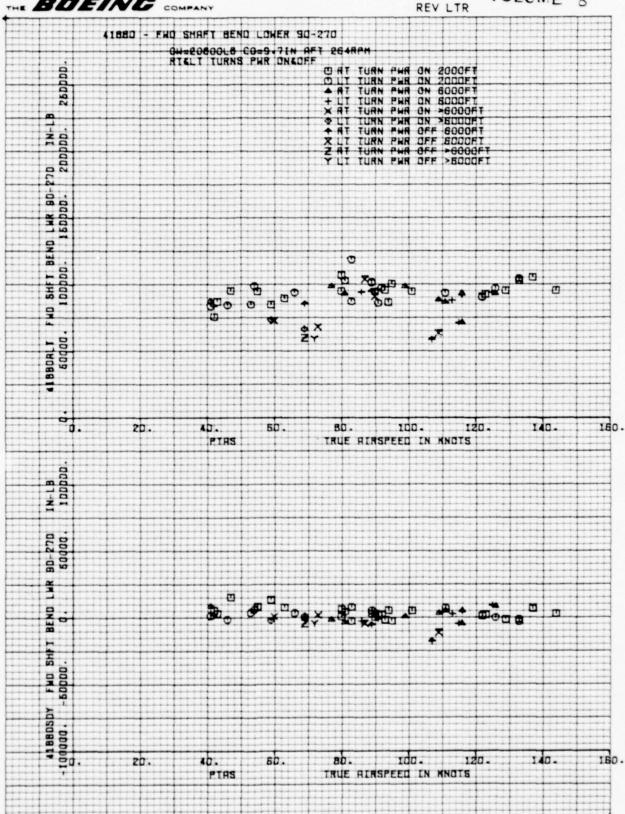
X CP PULLUP PHR OFF ANY HO

X CP PULLUP PHR OFF ANY ALT 260000 FWD SHFT BEND LWR BD-27D IN-LB 1000000. 1500000. 200000. X 0 8 X OA SOGOO. 20. 4D. 60. 140. 80. 100. 150 . PIRS TRUE RIRSPEED IN KNOTS I DODOO. BEND Y FWD SHFT . 41 8805DY 20. 60. 120. 140. 180. 4D. Bb. Ido. TAS TRUE AIRSPEED IN KNOTS

FORM \$2300 (10/71)

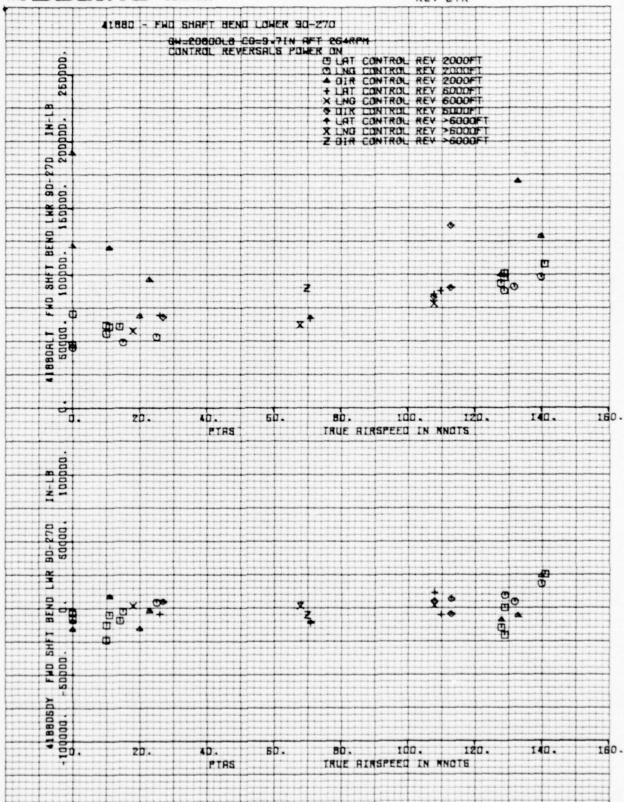
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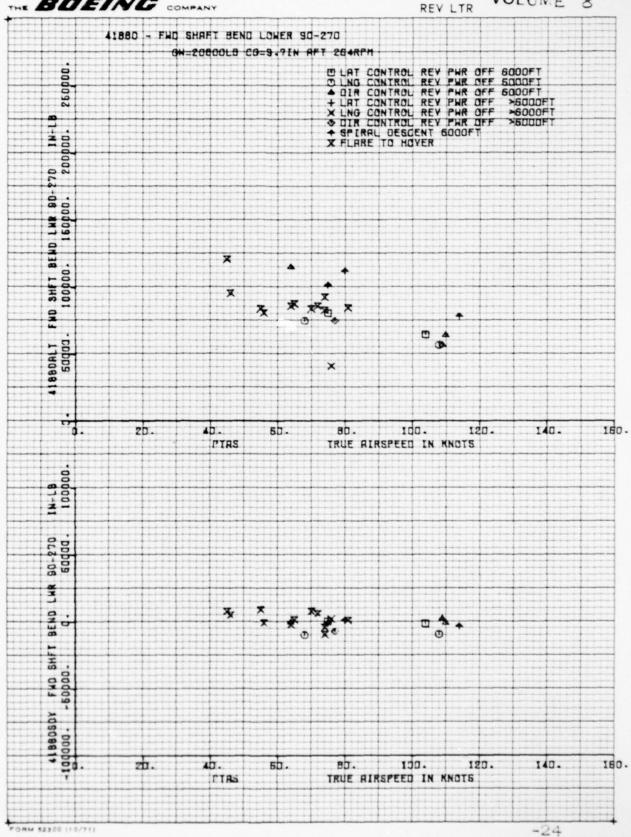
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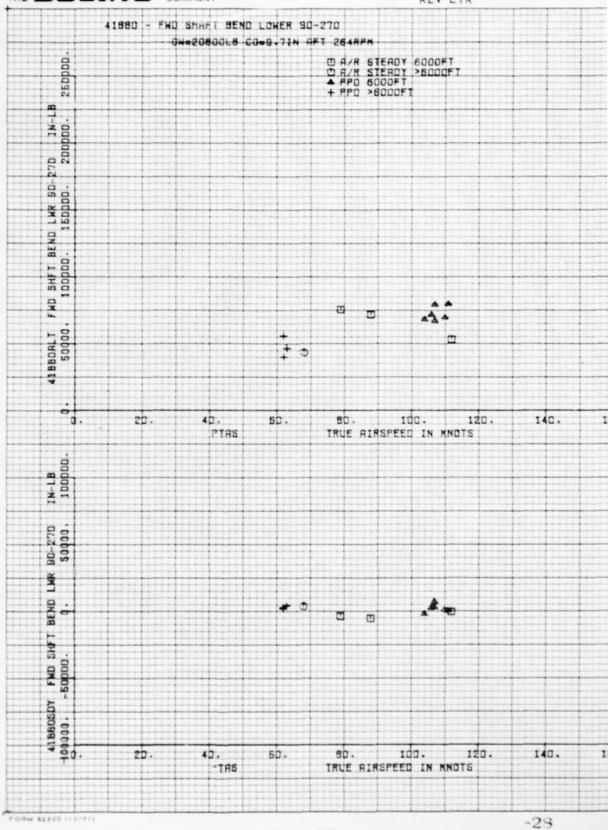
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FORM \$2300 (10/71)

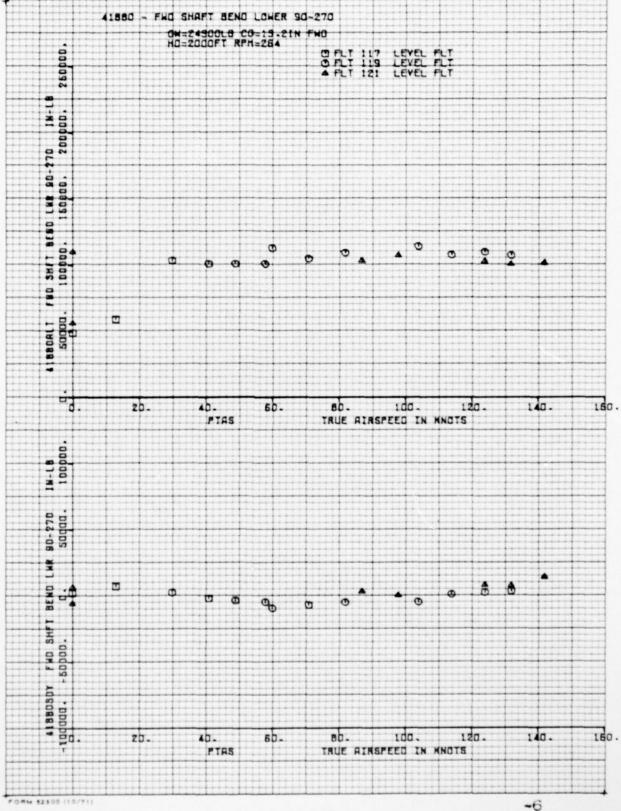




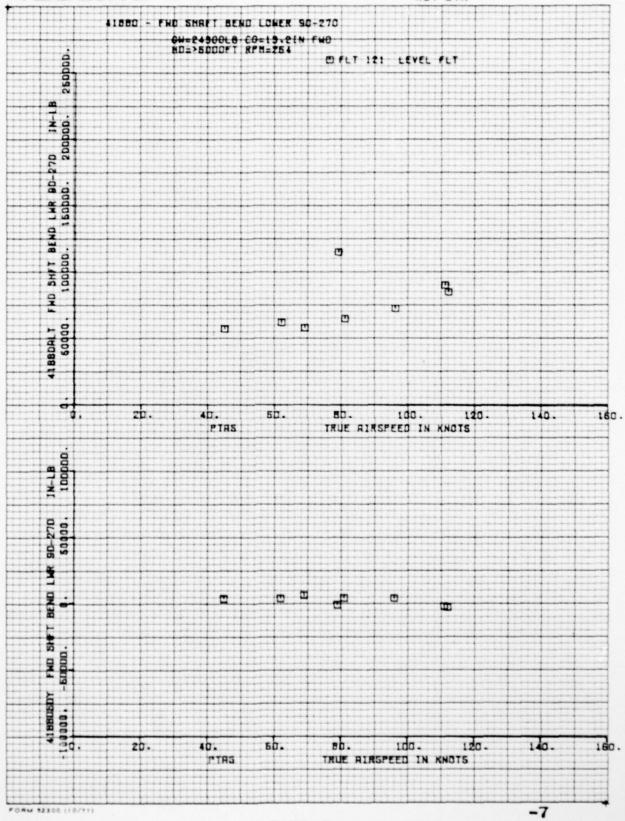
NUMBER REV LTR

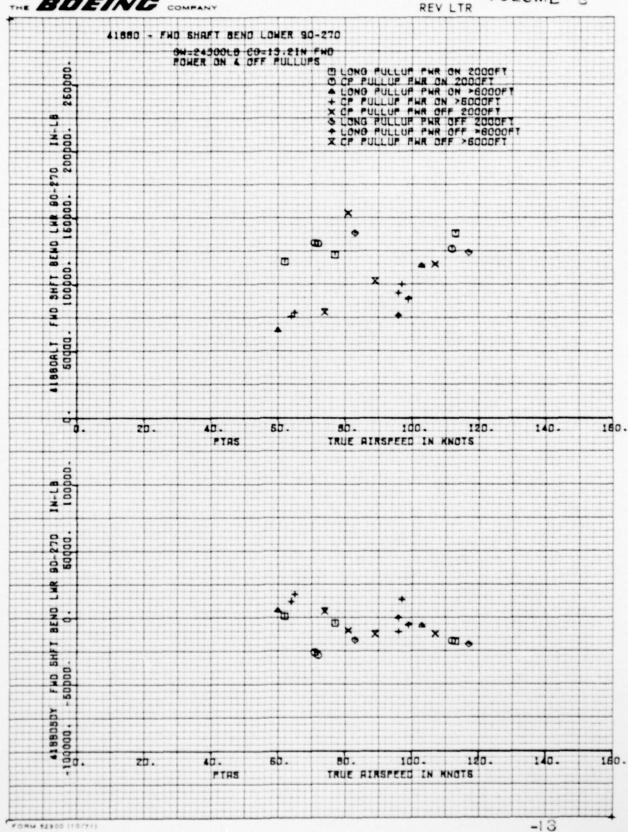


NUMBER REV LTR VOLUME 8



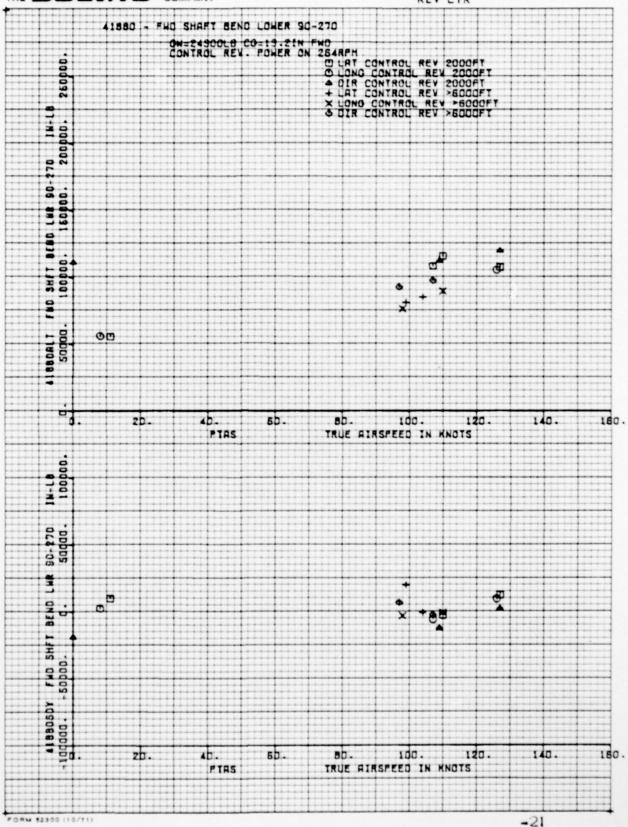
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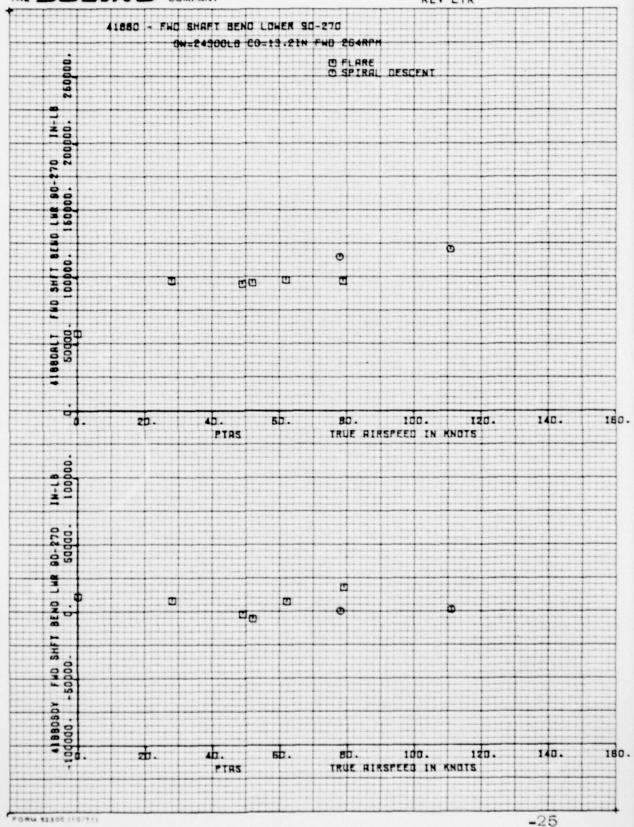


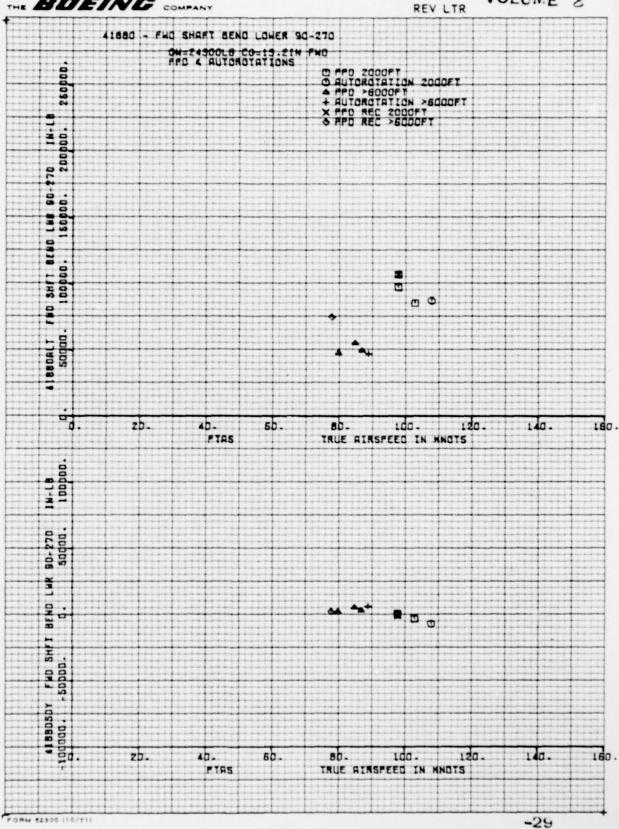
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FORM \$2300 (10/71)

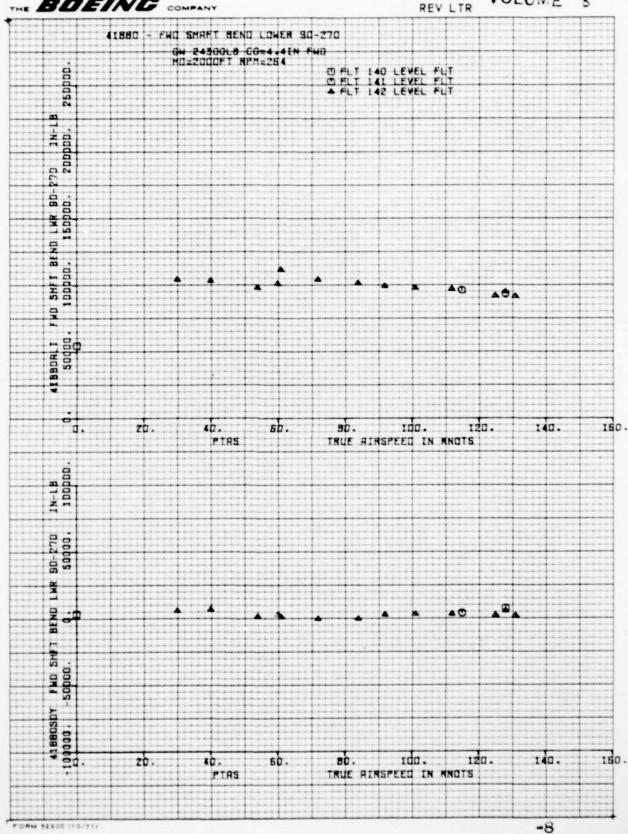


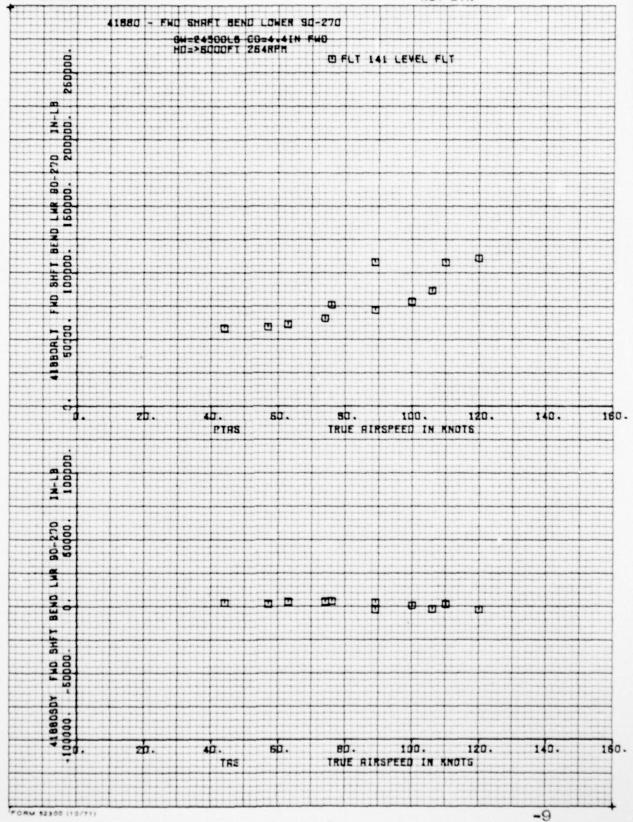
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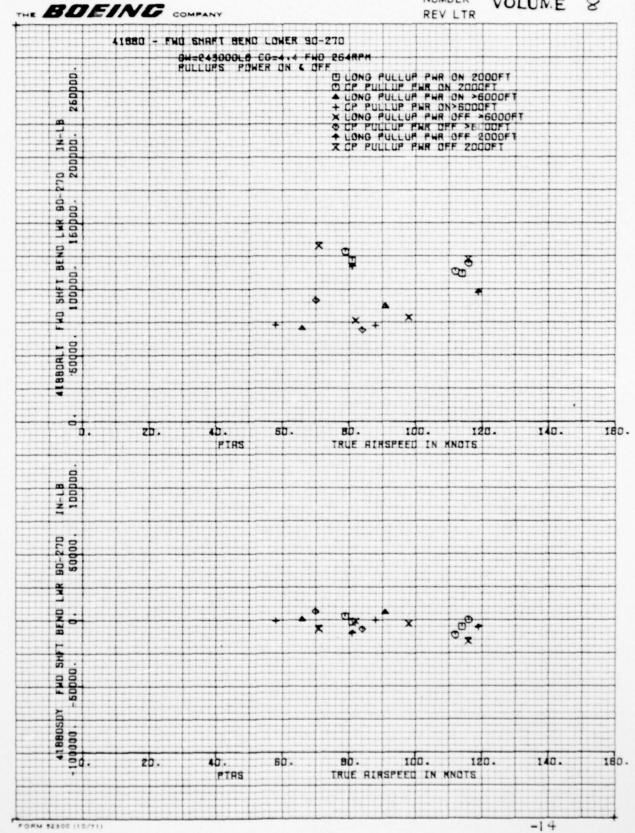
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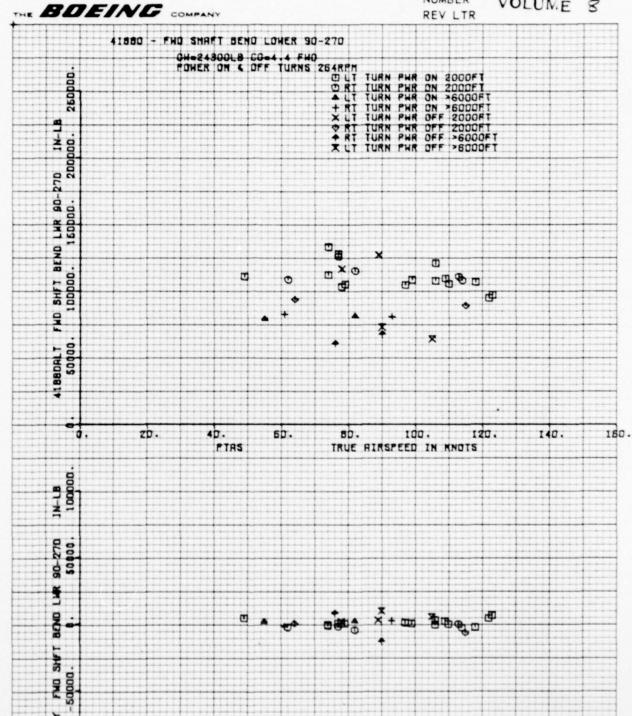




NUMBER

VOLUME





80.

60.

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FORM \$2300 (10/71)

FTRS

100.

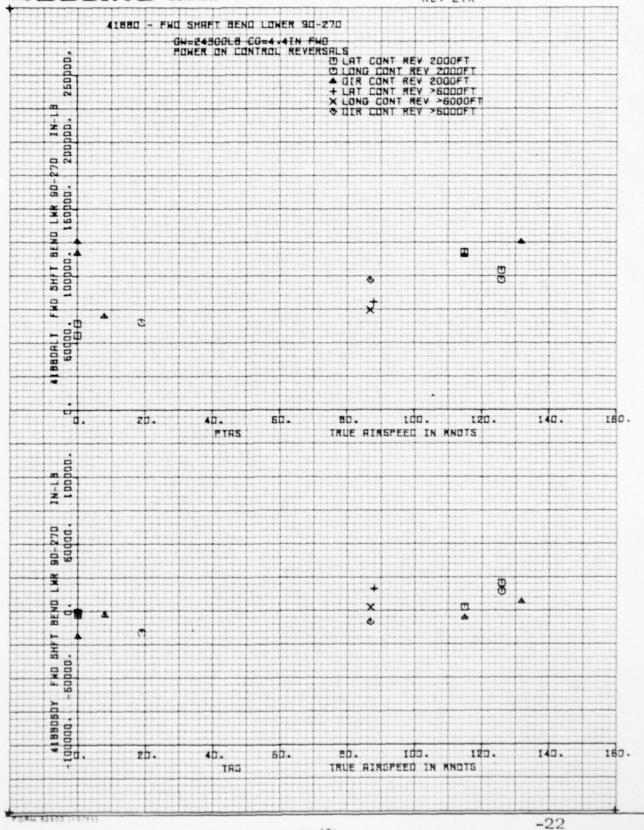
TRUE RIRSPEED IN MNOTS

120 .

140.

-18

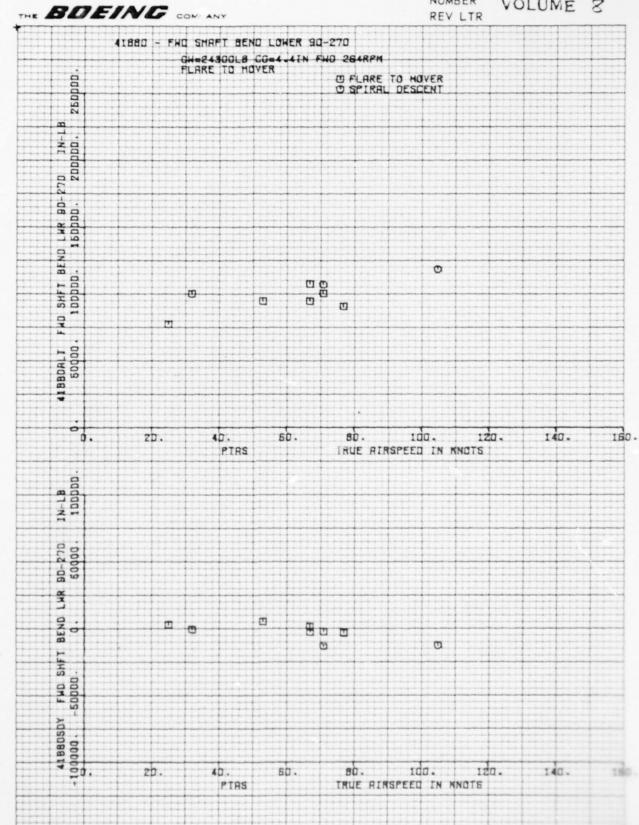
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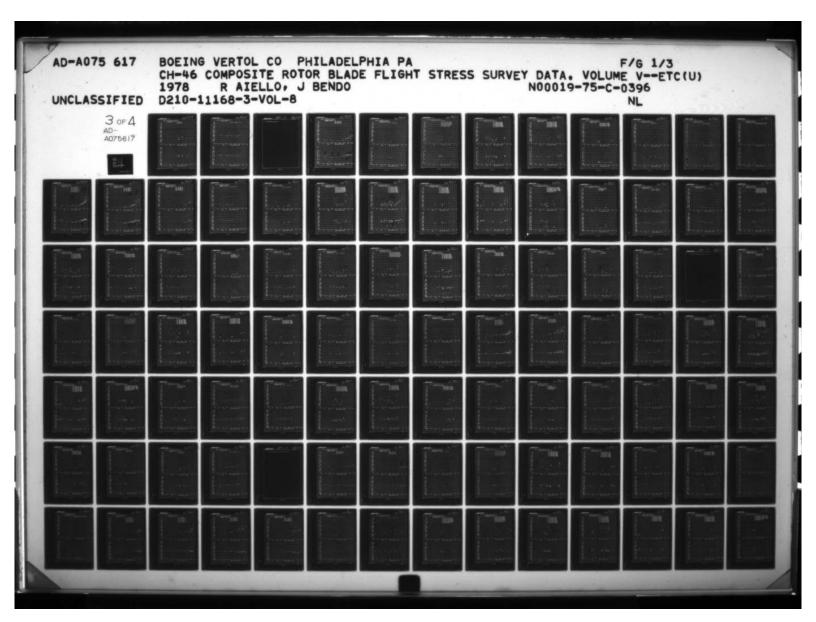
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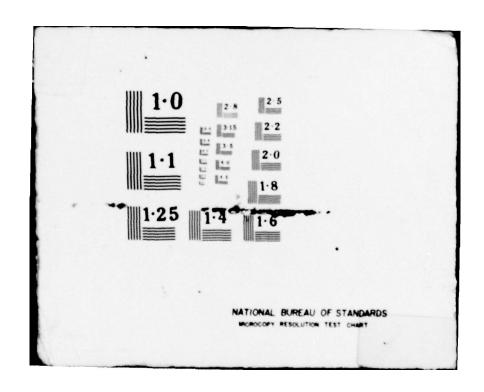
VOLUME 8

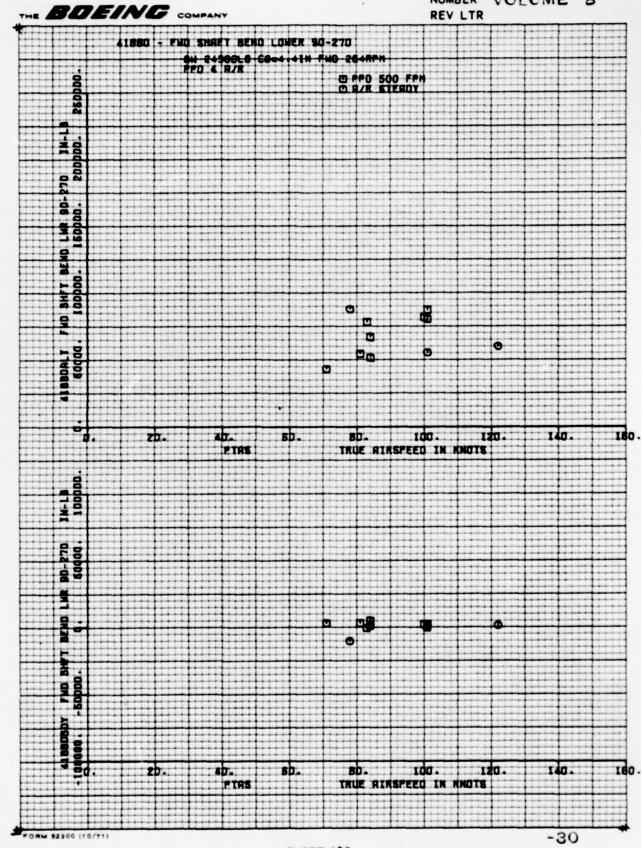
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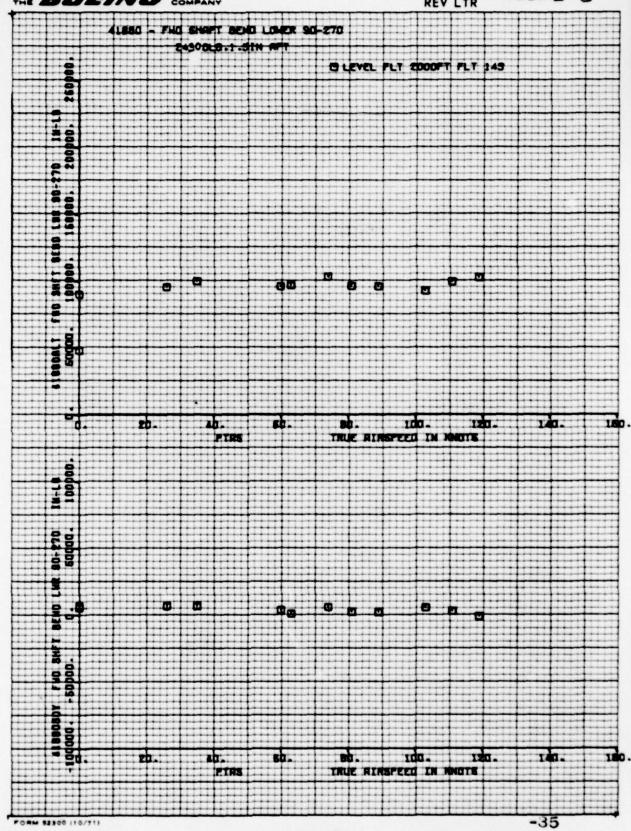


FORM \$2300 (10/71)









PREPARED BY: J. Bendo

THE BOEING COMPANY DATE:

8/28/78

NUMBER D210-11168-3 REV LTR Volume 8

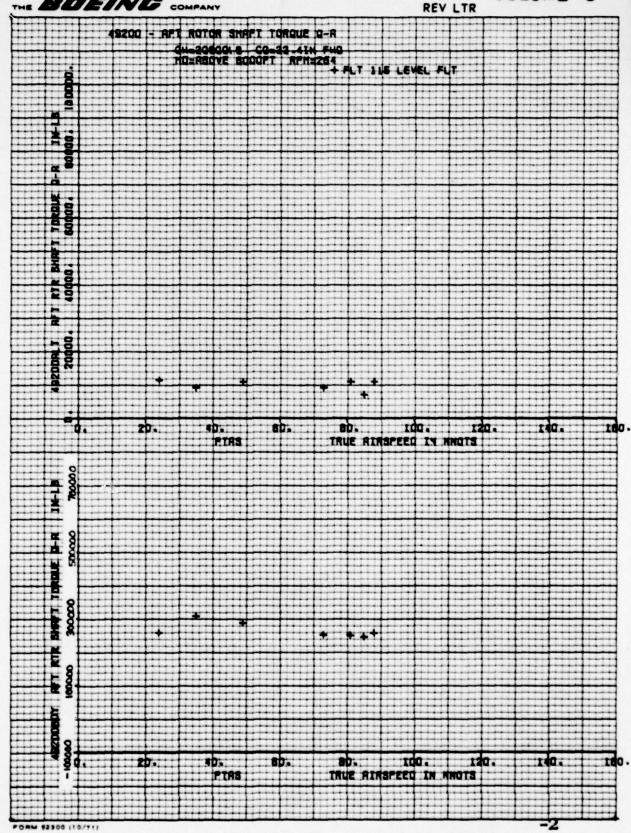
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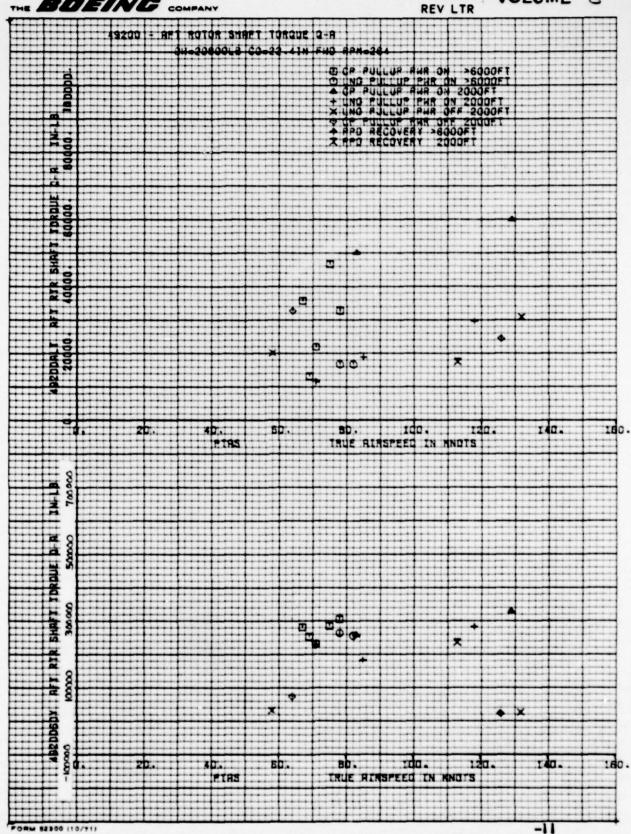
4.6 Aft Rotor Shaft Torque

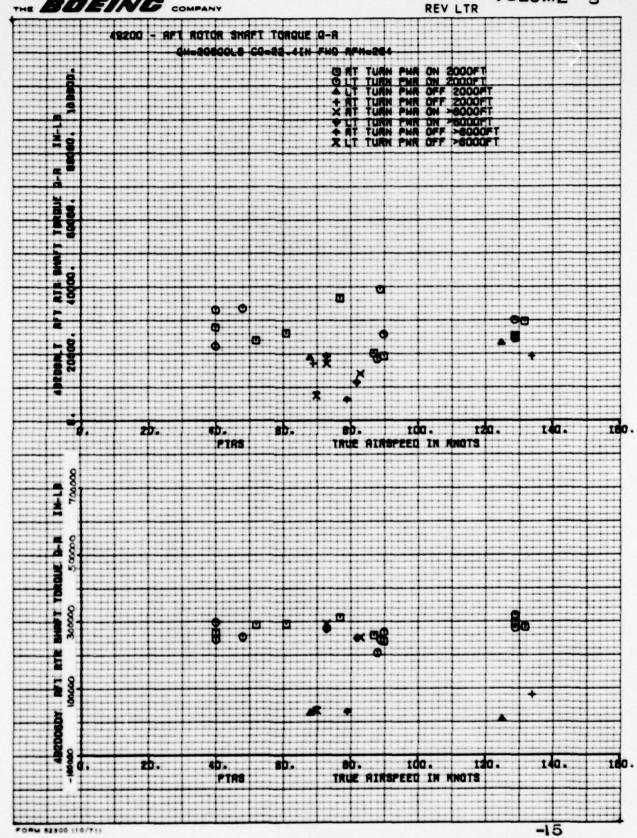
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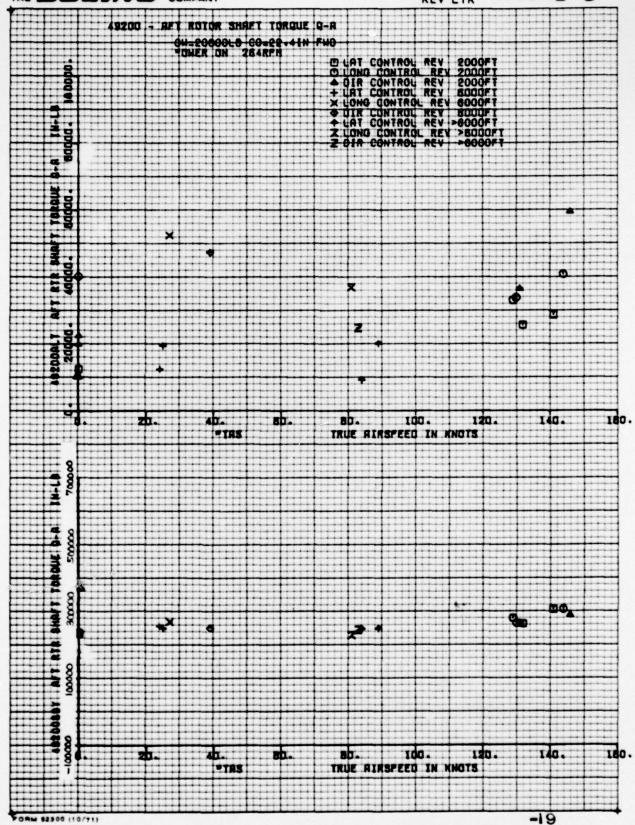
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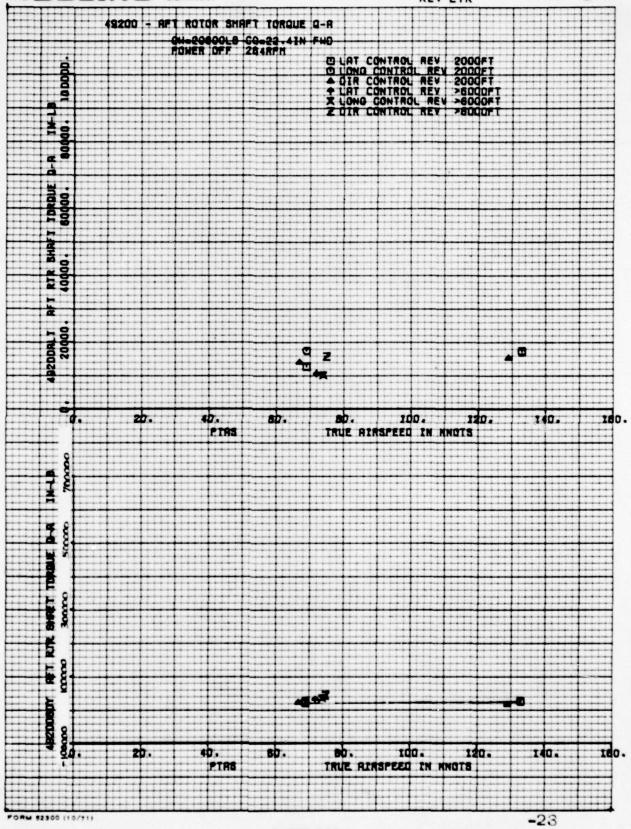
BOEING COMPANY

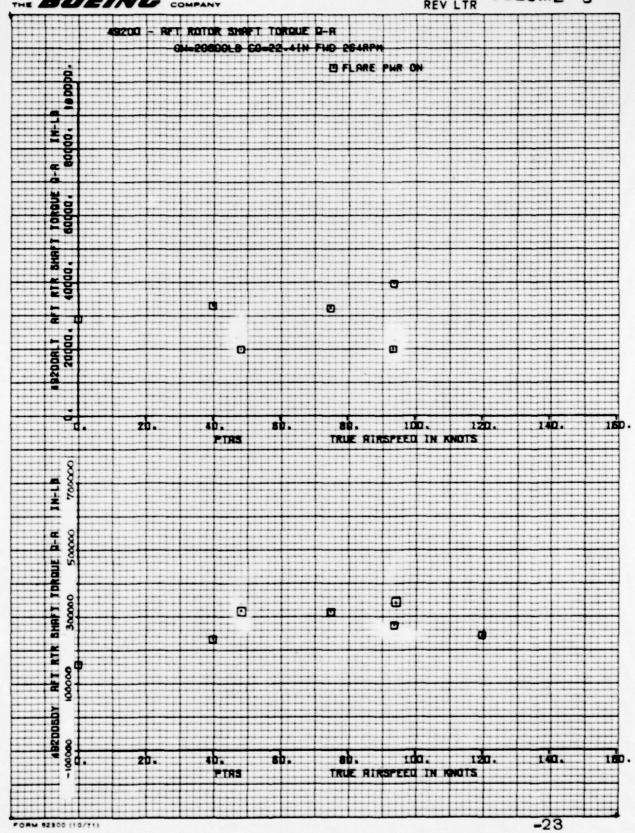


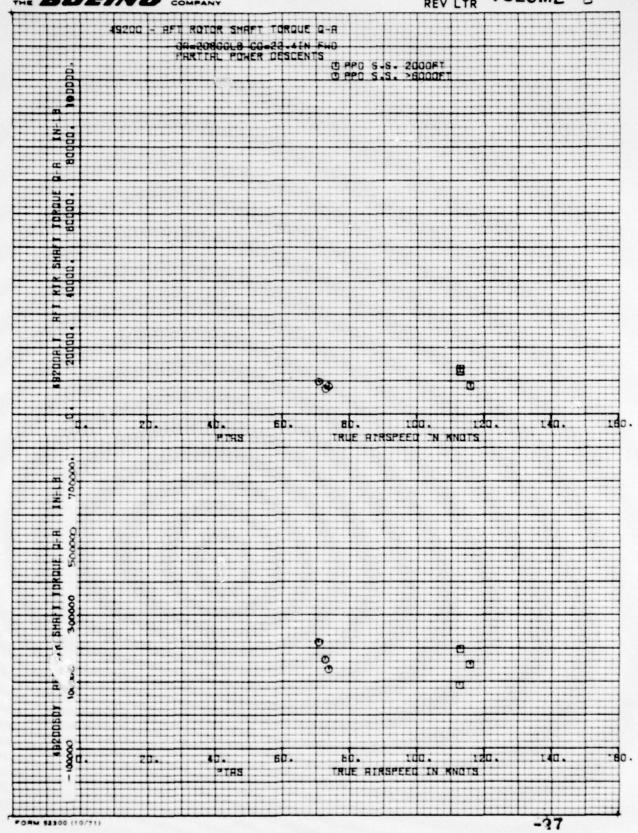


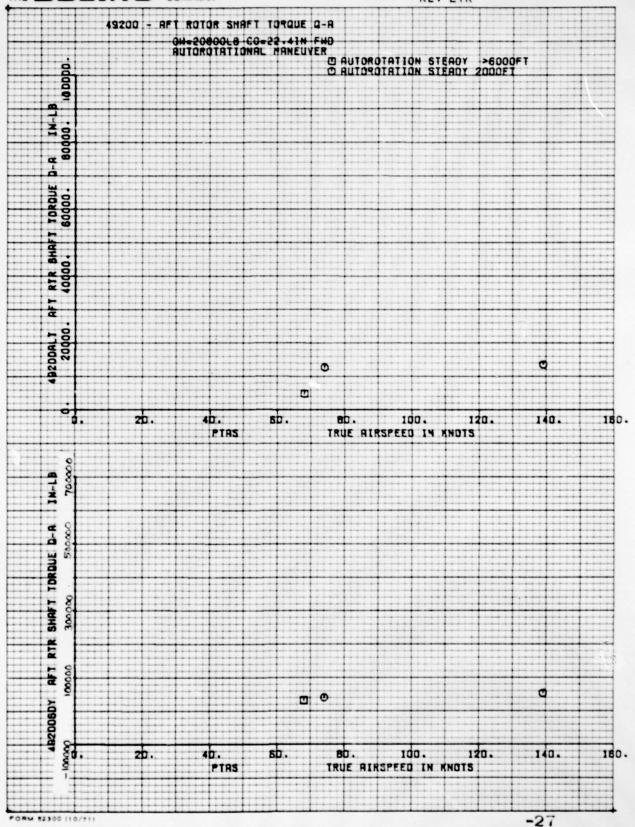


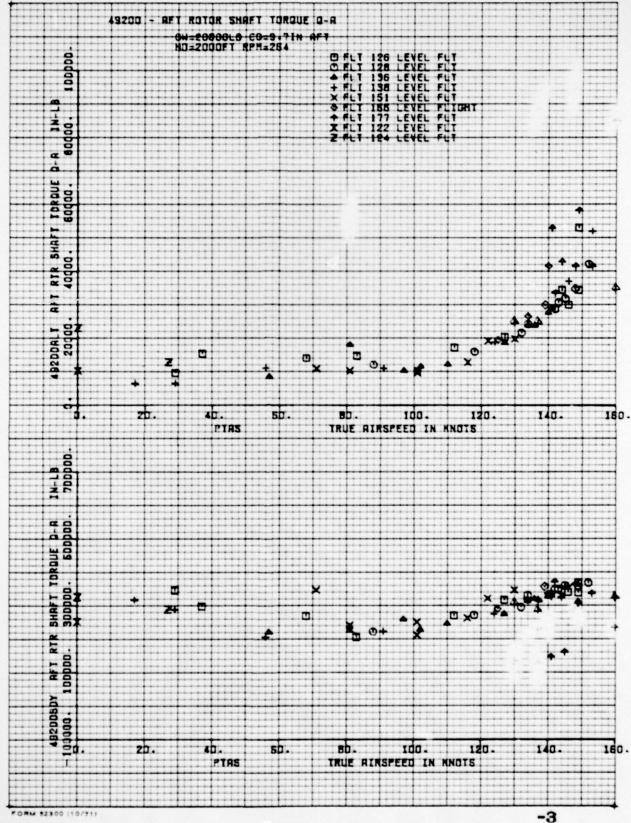


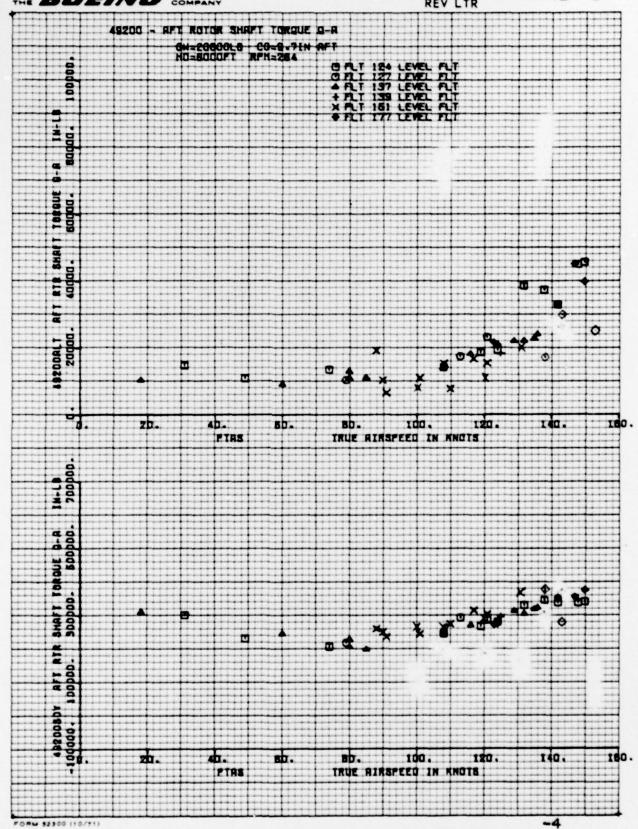




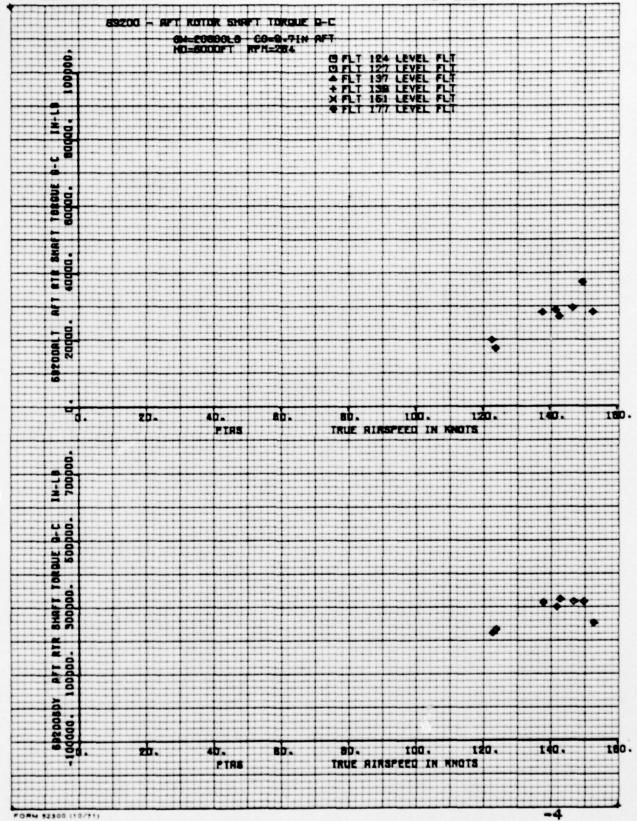


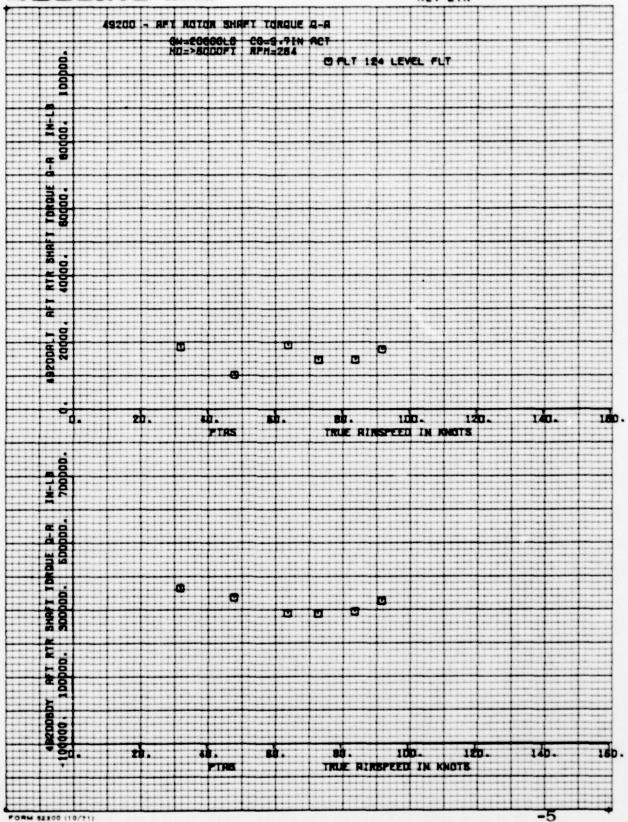


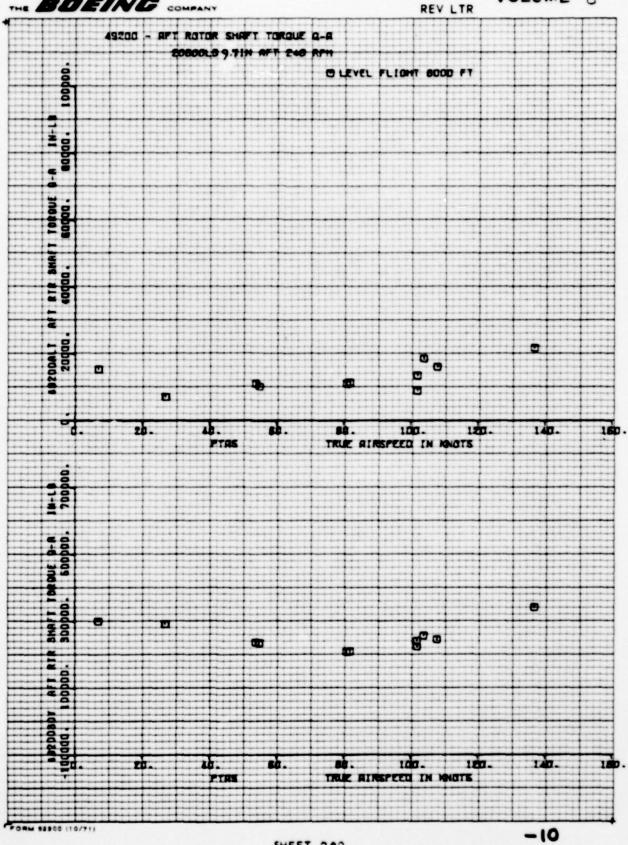


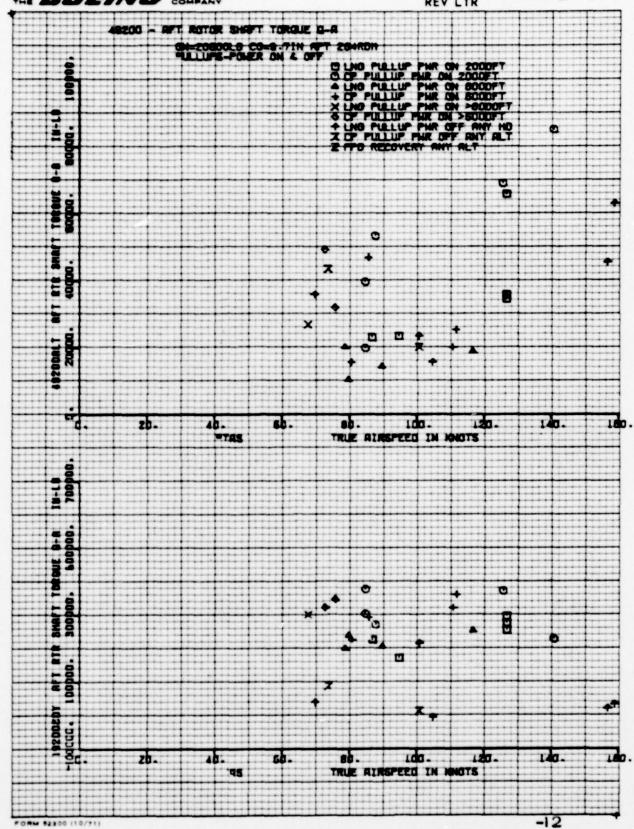


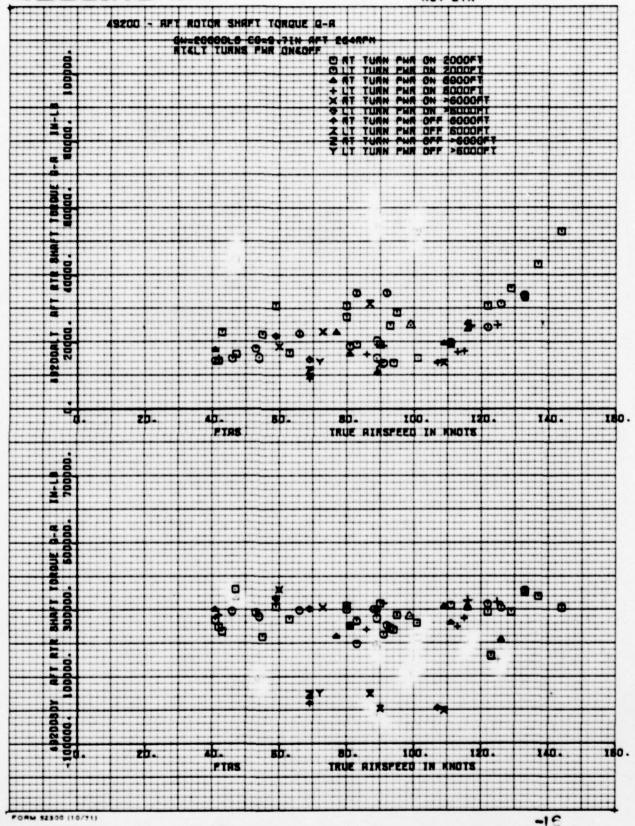
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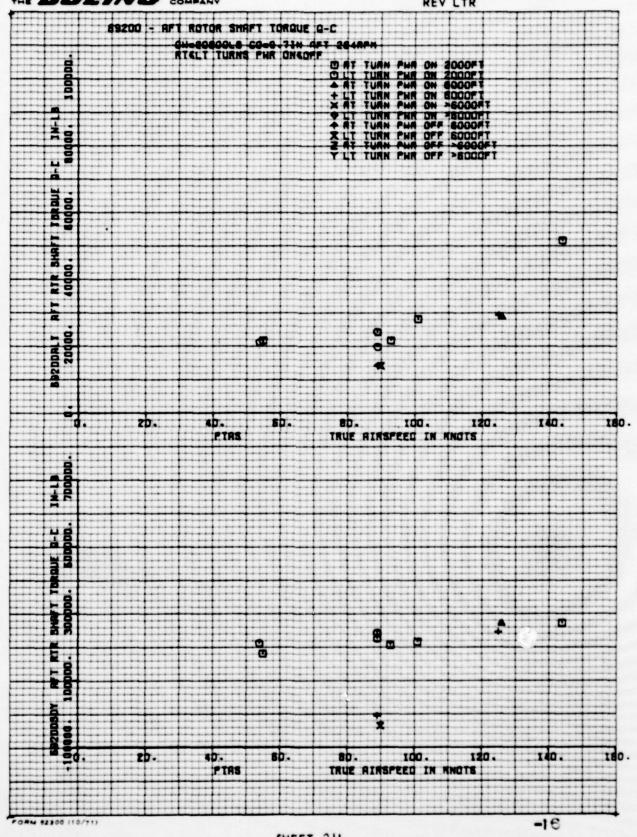


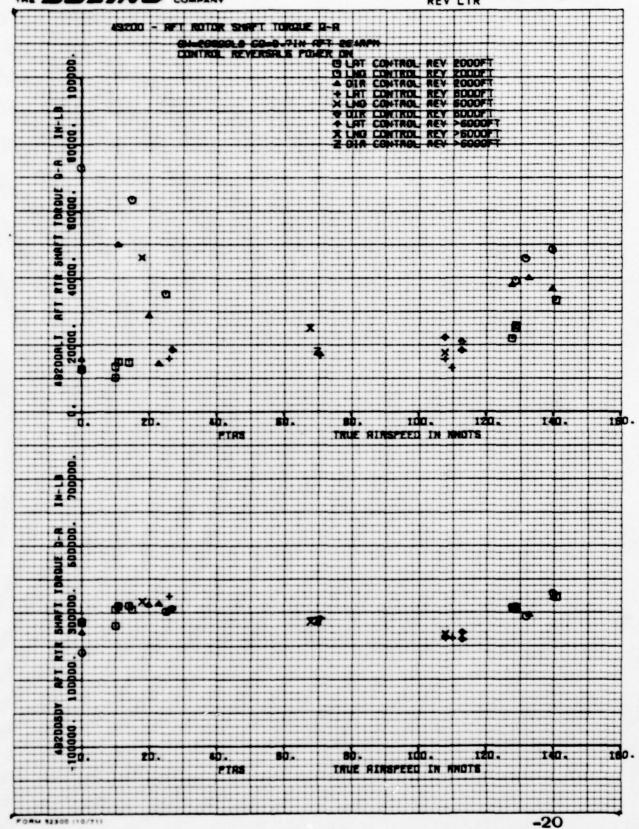


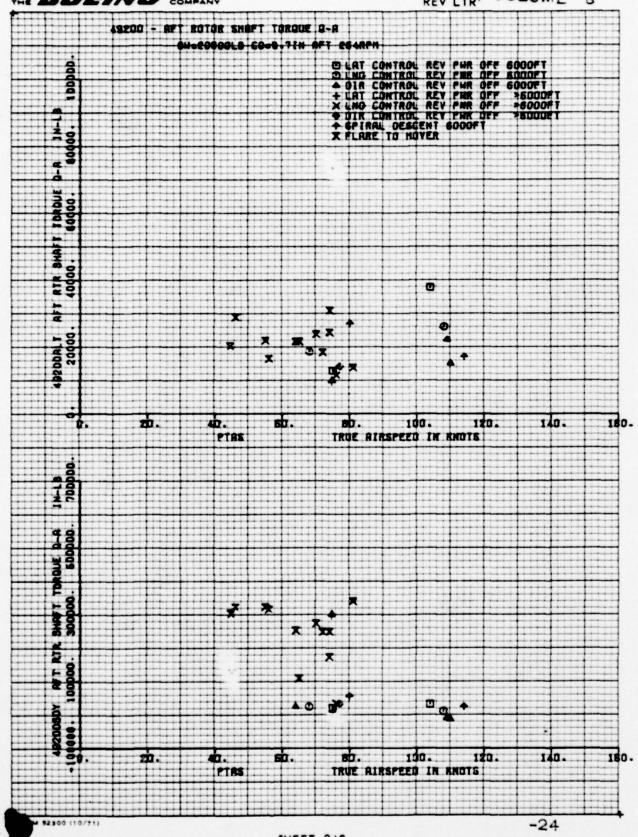




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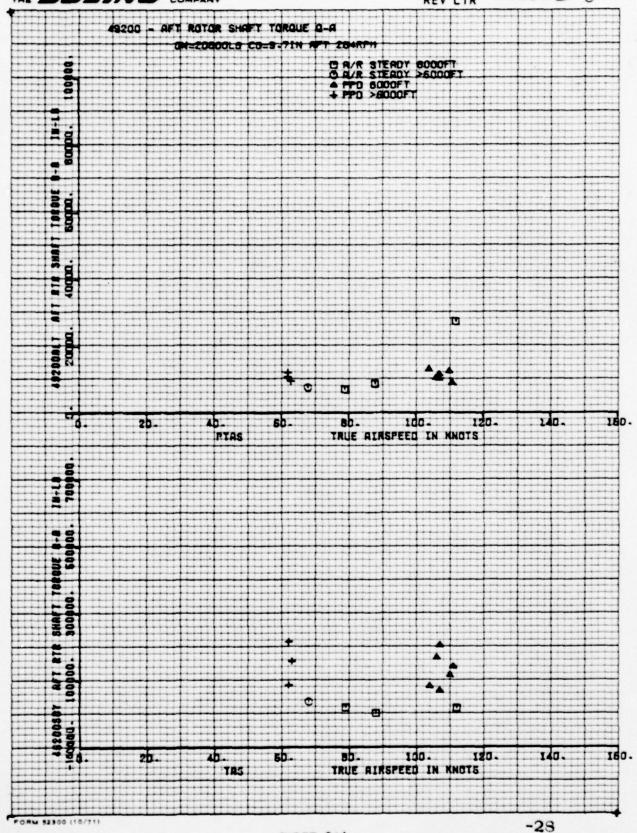


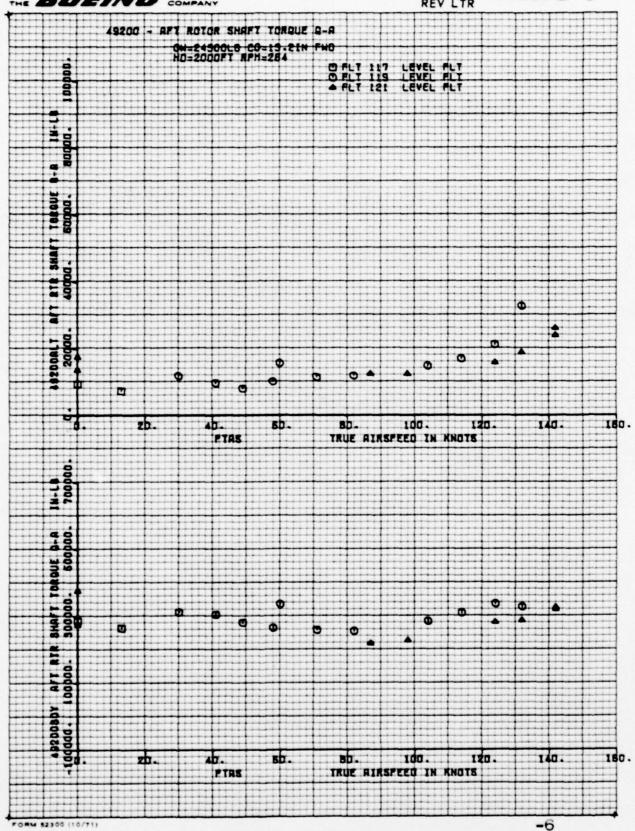


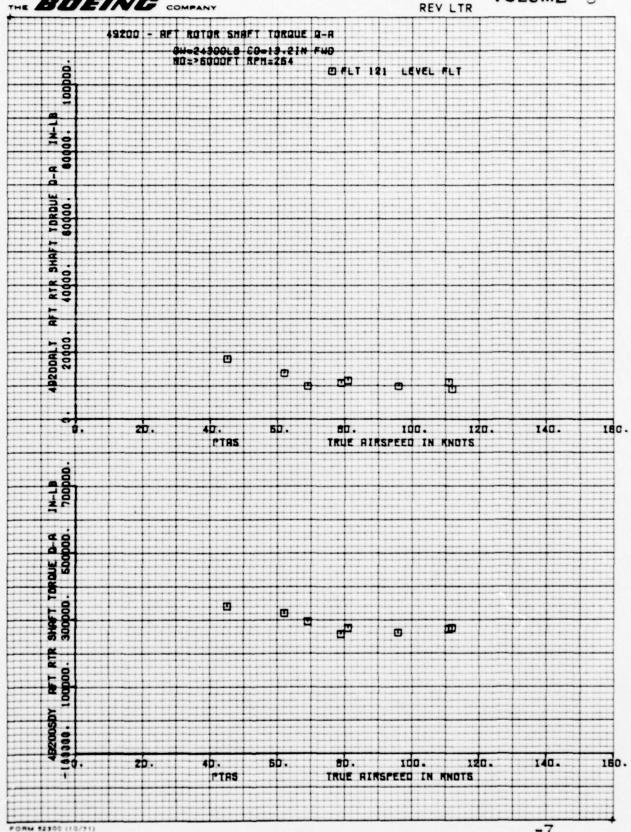


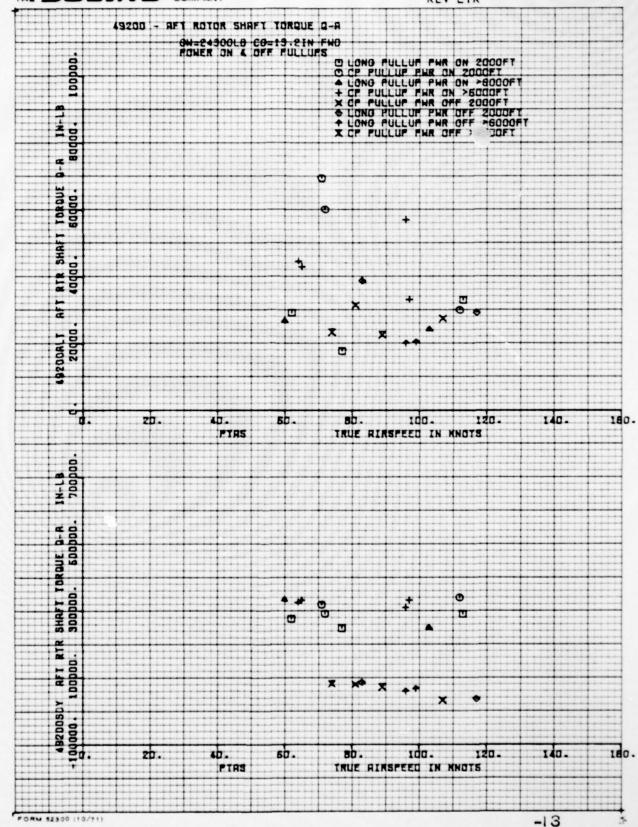
NUMBER NUMBER VOLUME 8



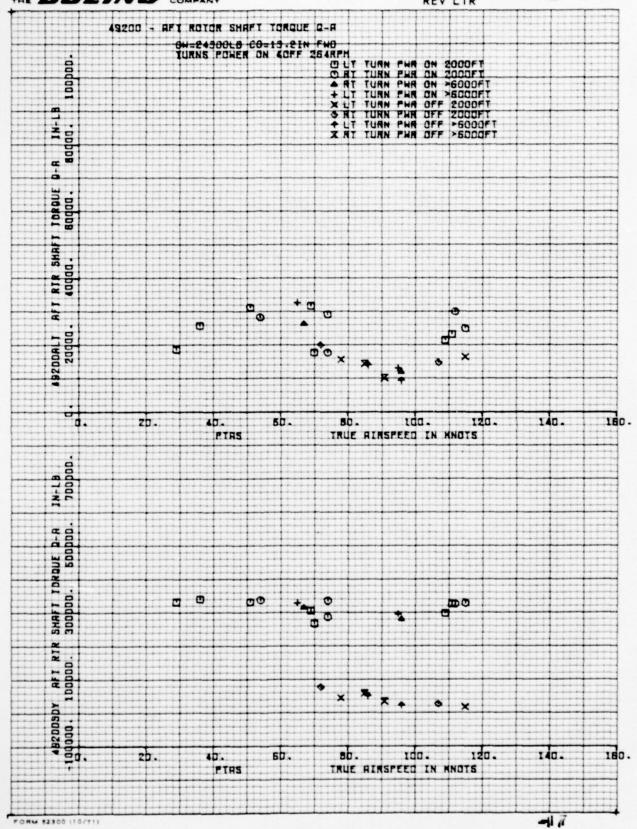


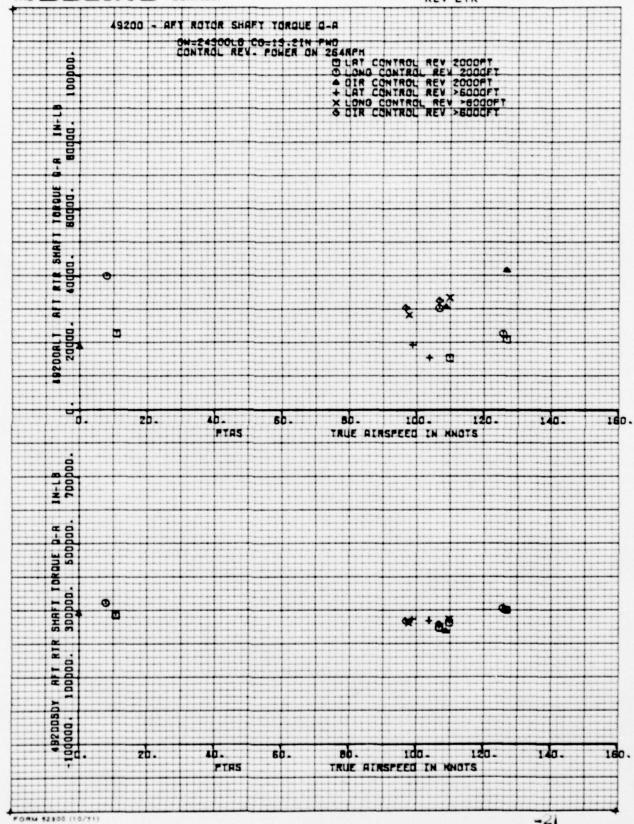






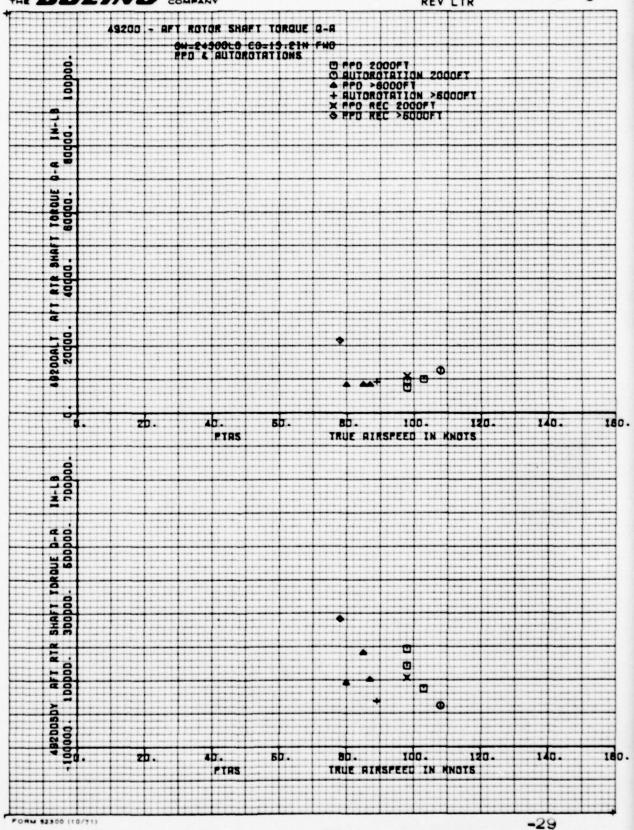
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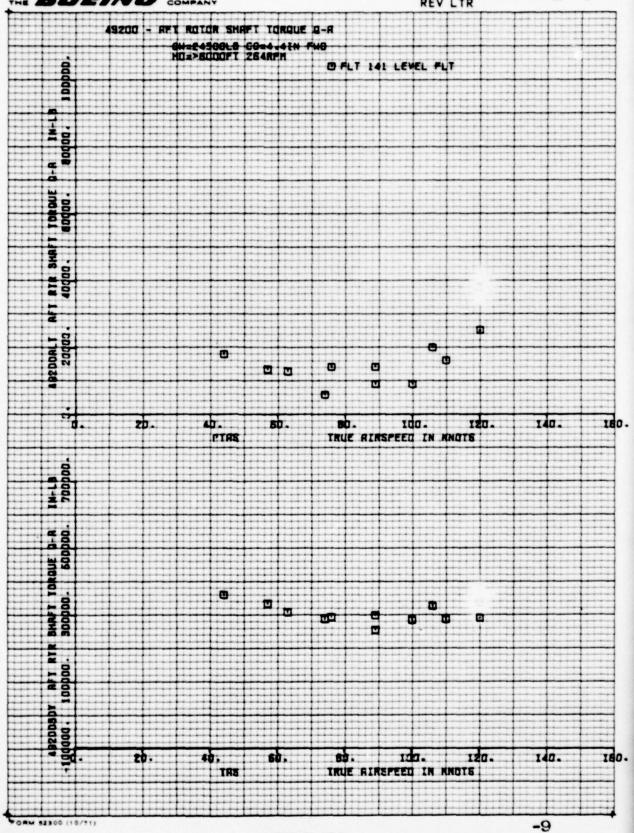


-25

THE BOEING COMPANY REV LTR 49200 - RET ROTOR SHAFT TORQUE Q-A \$4-24300L8 CG-13.21N FND 2648PH D FLARE DESCENT 1 00000 0 98 D 40. 20. sp. 190. 120. 150 -TRUE RINSPEED IN KNOTS! PTRS D M 0 0 140. 40. 100. 160. 20. TRUE BIRSPEED IN KNOTS PTAS



D210-11168-3 NUMBER VOLUME 8 THE BOEING COMPANY REV LTR 49200 - AFT ROTOR SHAFT TORQUE Q-A GU 24500L8 CG=4.4[N FUB HD=2000FT RPH=284 B-R IN-LB BODDD. OFLT 140 LEVEL FUT SHAFT TOROUE 30. 60400. -0 ab. 140. 5D. Ida. 160. zb. 80. 120. TRUE RINSPEED IN MNOTS FIRS 60. 100. 120. 140. 160 . 10. TRUE RIRSPEED IN MNOTS FTAS FORM \$2100 (10/71) -8 SHEET 222

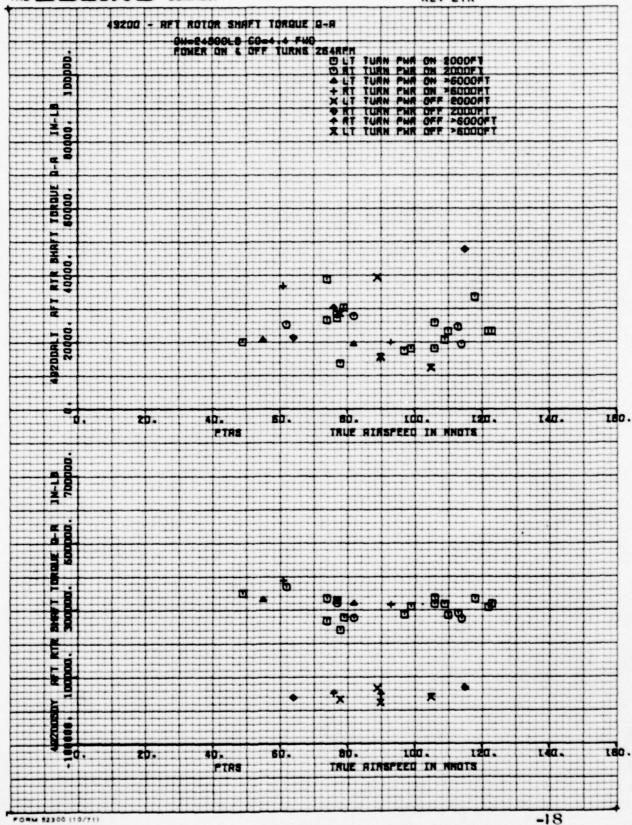


NUMBER VOLUME 8

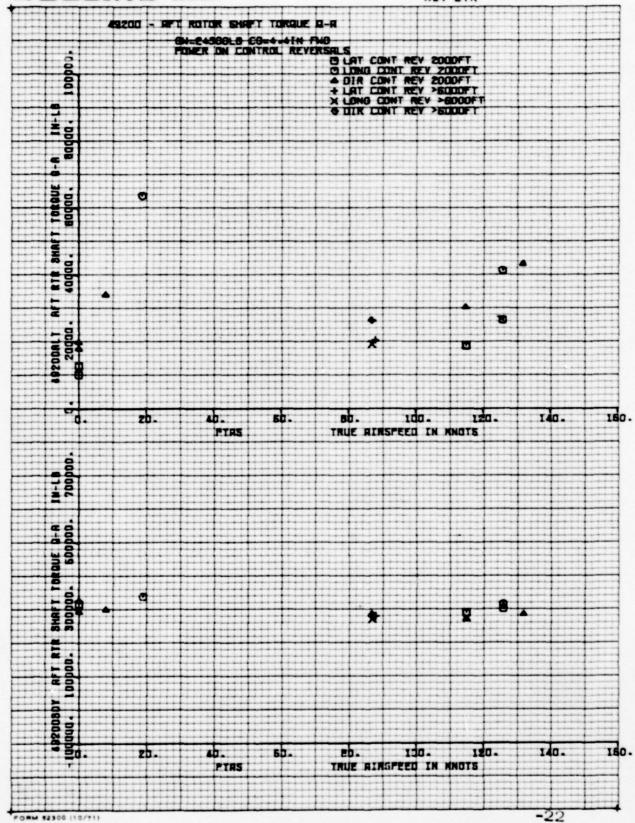
THE BOEING COMPANY REV LTR 49200 - AFT ROTOR SHAFT TORQUE Q-A CH-245000LE CO-4.4 FHD 264RPH PULLUPS POWER ON & OFF CO LONG PULLUP PHR ON 2000FT
CO CP PULLUP PHR ON 2000FT
LONG PULLUP PHR ON >6000FT
CP PULLUP PHR ON >6000FT
X LONG PULLUP PHR OFF >6000FT
CP PULLUP PHR OFF >6000FT
CP PULLUP PHR OFF 2000FT
X CP PULLUP PHR OFF 2000FT 0 0 × 60. 80. 140. ZD. AD. 100. 120. IBO -PTRS TRUE RIRSPEED IN MNOTE d 0.0 0 D X . D. ZD. 60. 80. 100. 120. 140. 180. FTRS TRUE RINSPEED IN MNOTE FORM \$2300 (10/71) -14

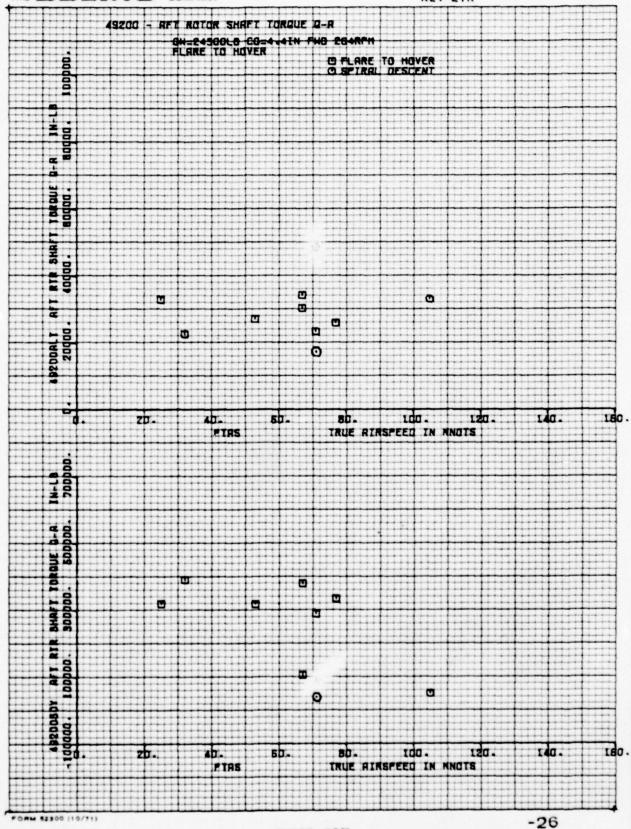
SHEET 224

NUMBER VOLUME 8

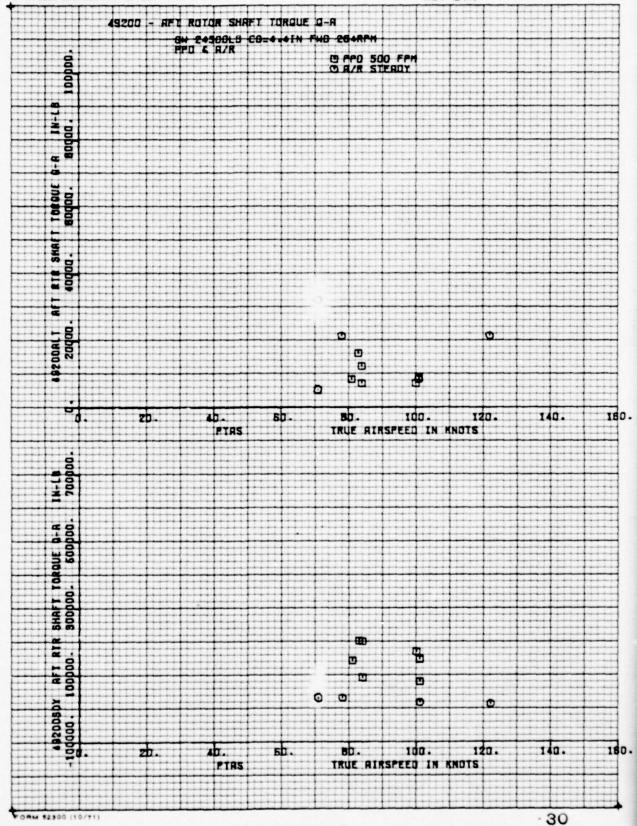


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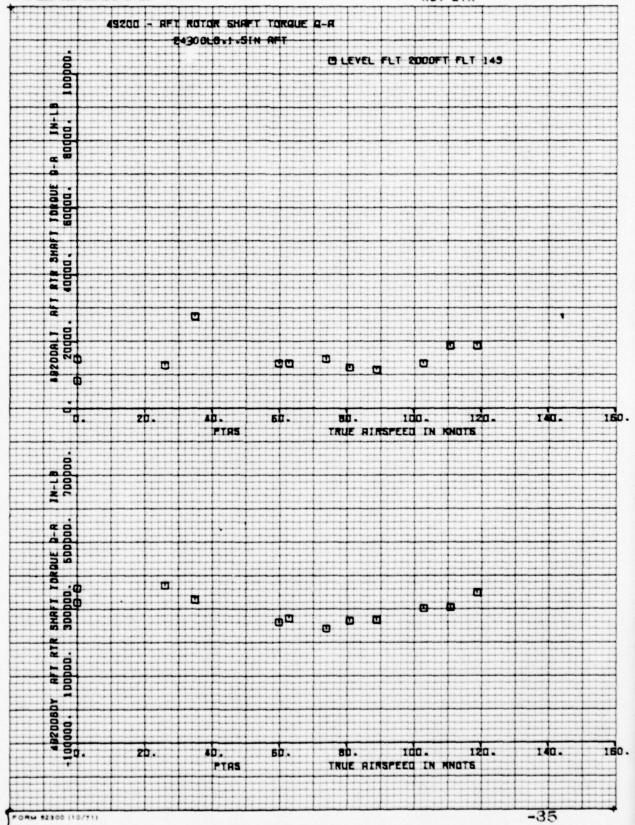




NUMBER VOLUME 8



NUMBER REV LTR D210-11168-3



PREPARED BY: J. Bendo

NUMBER D210-11168-3 REVLTR Volume 8

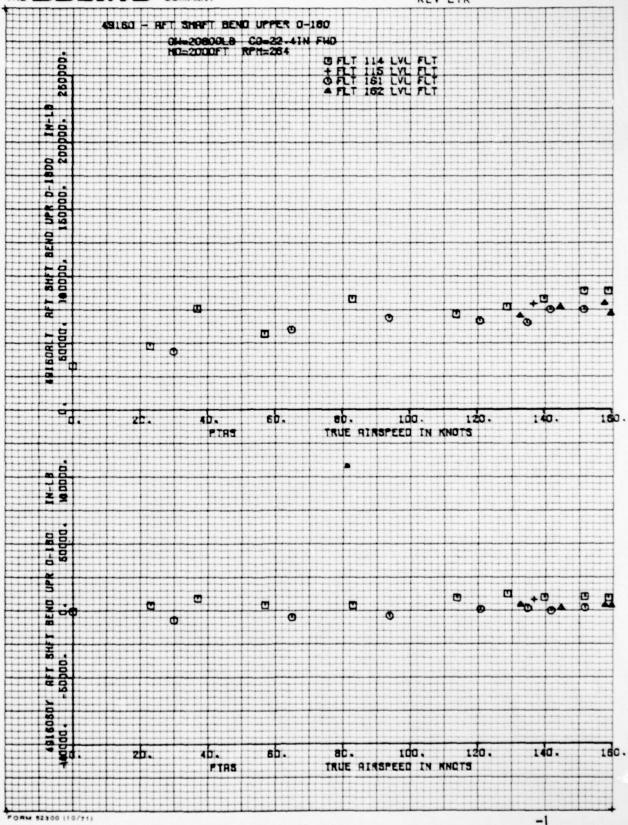
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THE BOEING COMPANY DATE:

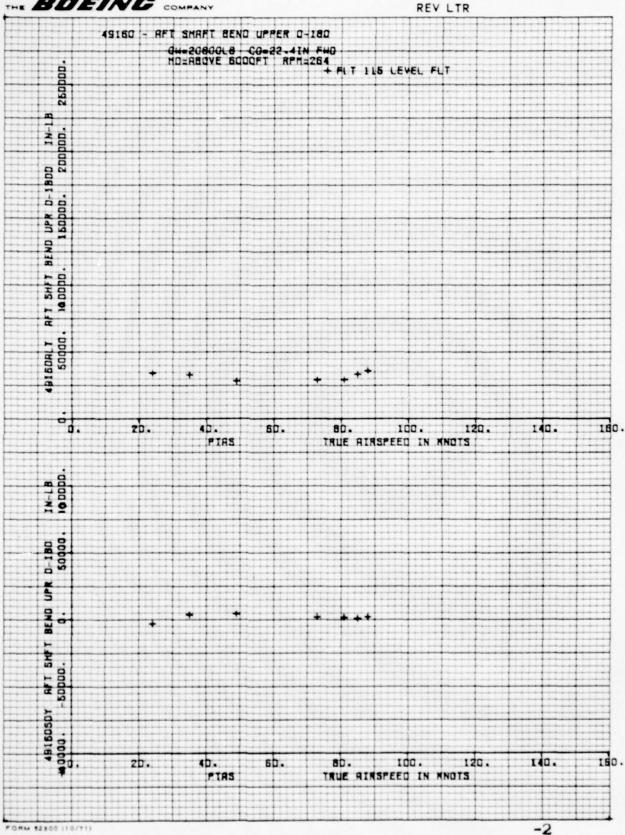
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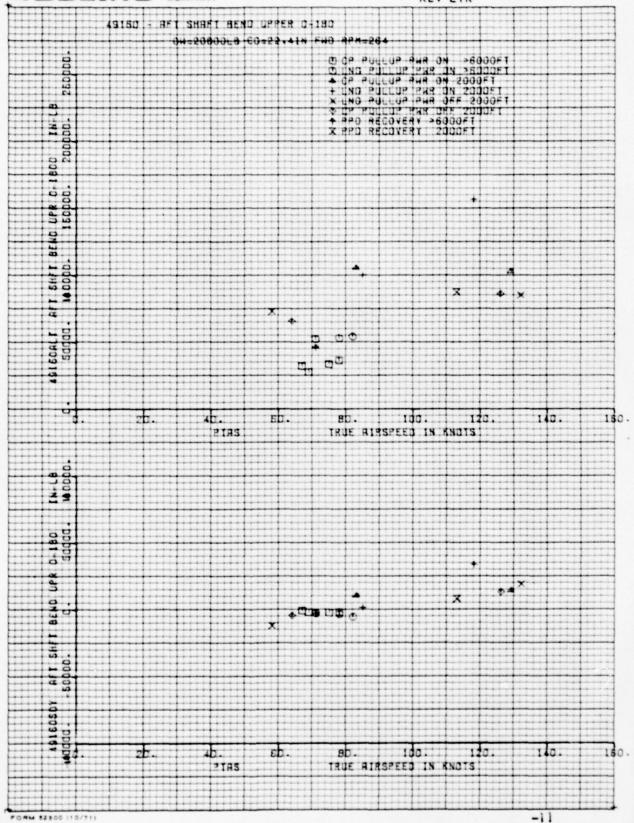
8/28/78

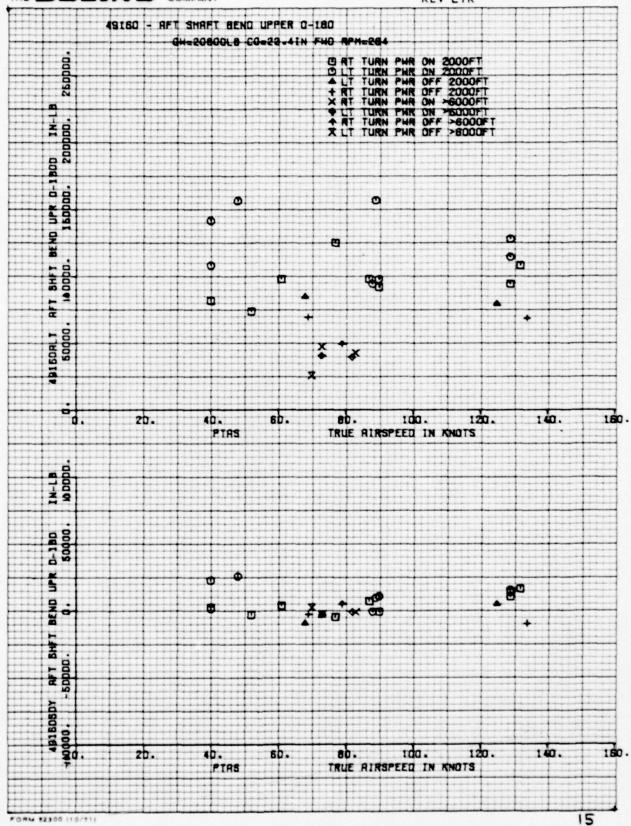
4.7 Aft Shaft Bending, Upper (0° - 180°)

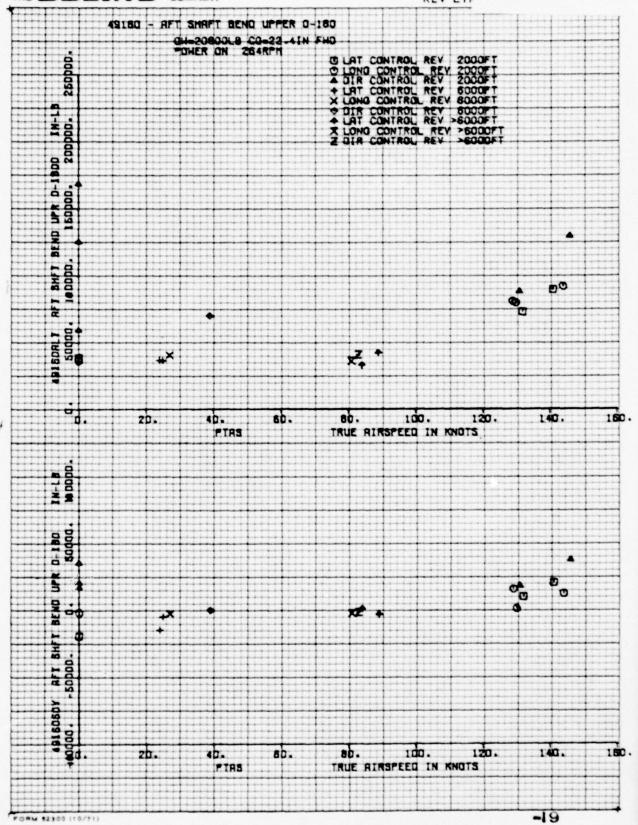


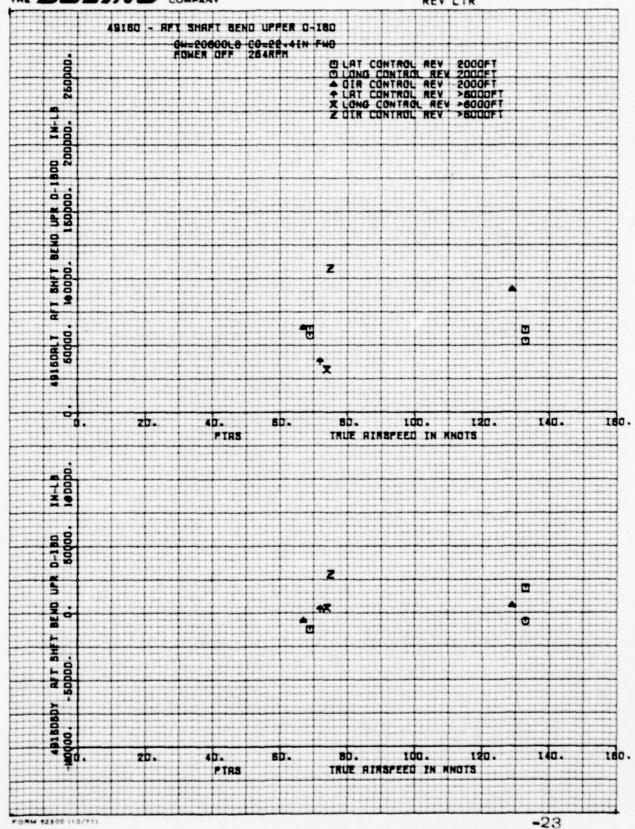
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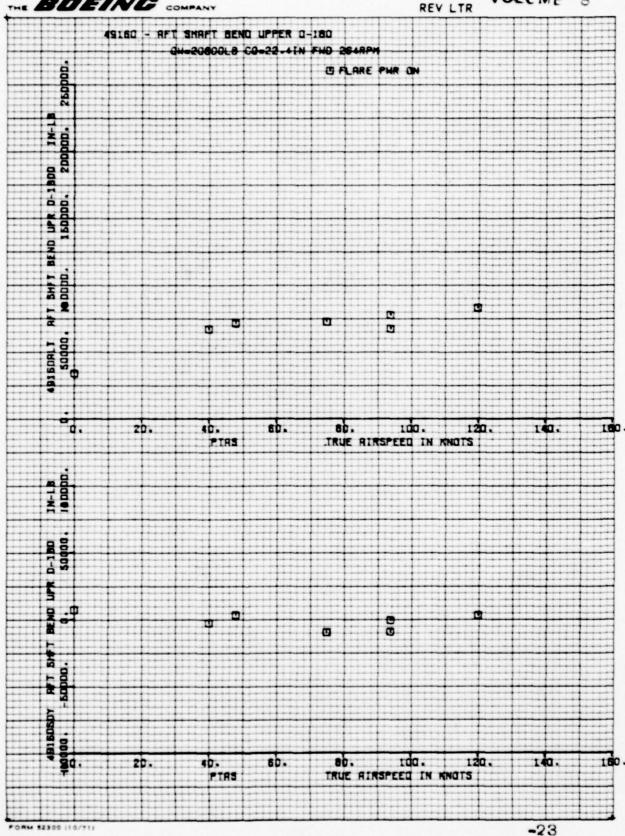


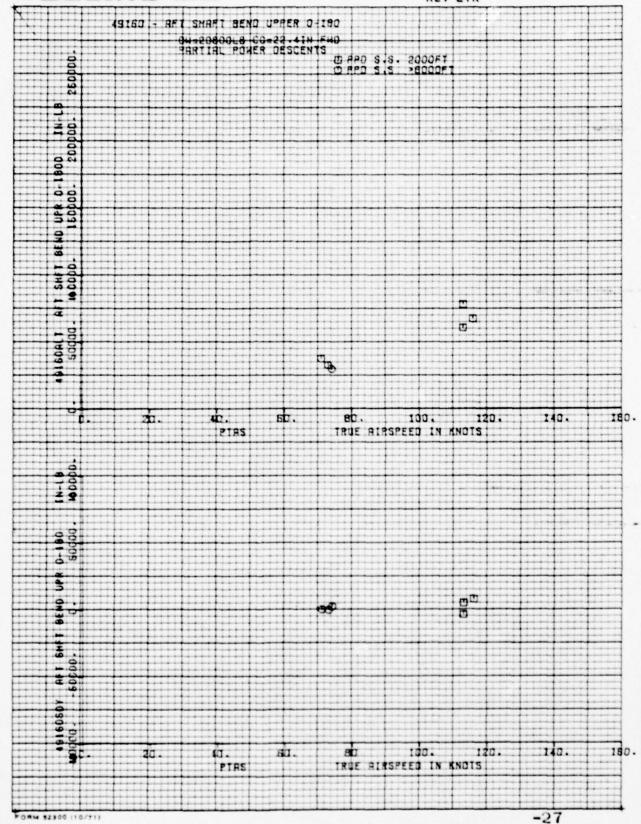










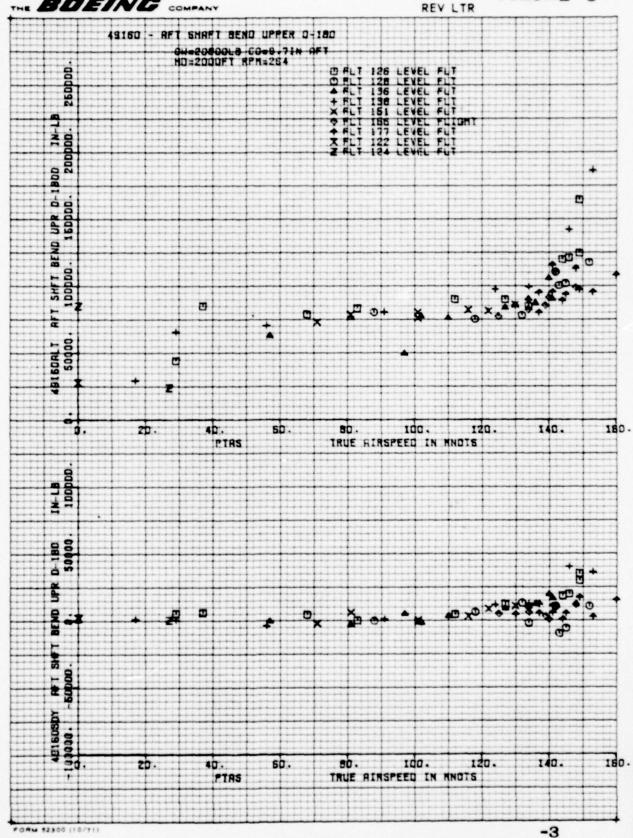


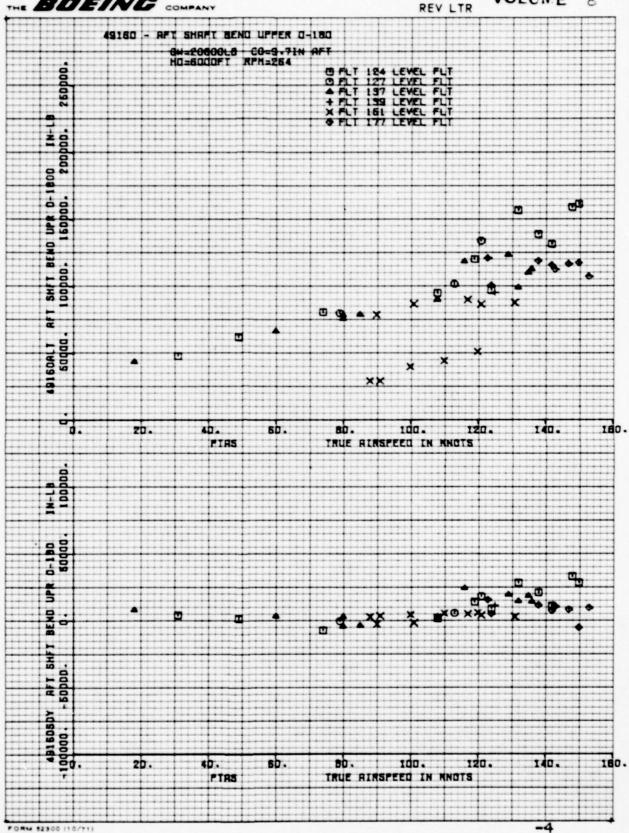
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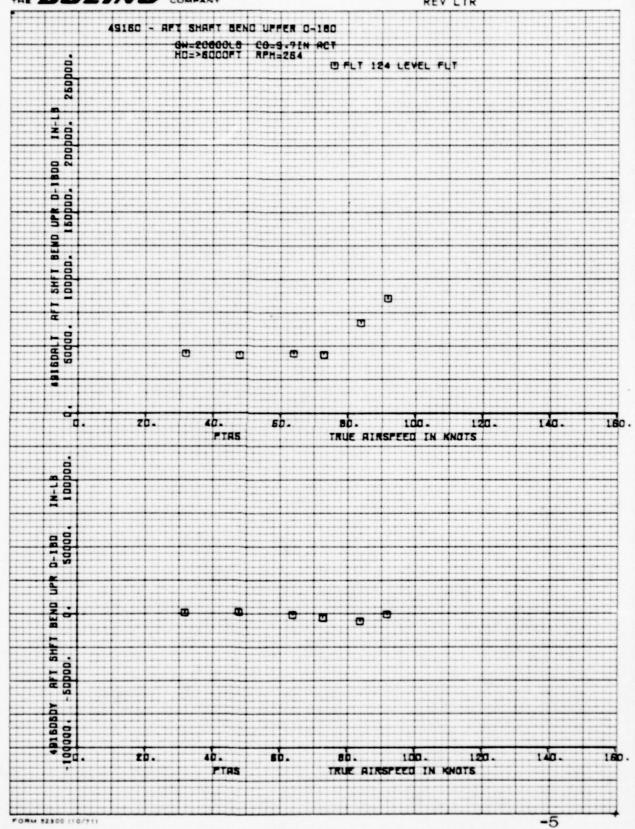
THE BOEING COMPANY 49160 - AFT SHAFT BENO UPPER 0-180 AFT SHFT BEND UPR D-1800 IN-L. 0 a 0 20. 60. 100. 40. TRUE AIRSPEED IN MNOTS PIAS 0 Y AFT SHFT -- SDDDD. 60. 100. 140. 160 . 40. TRUE RIRSPEED IN KNOTS PTAS -27

FORM \$2300 (10/71)

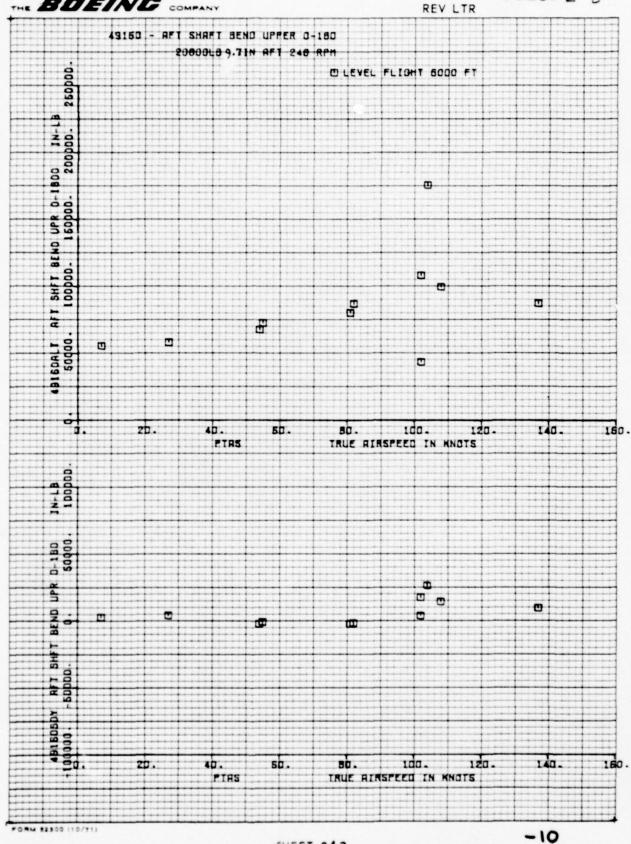
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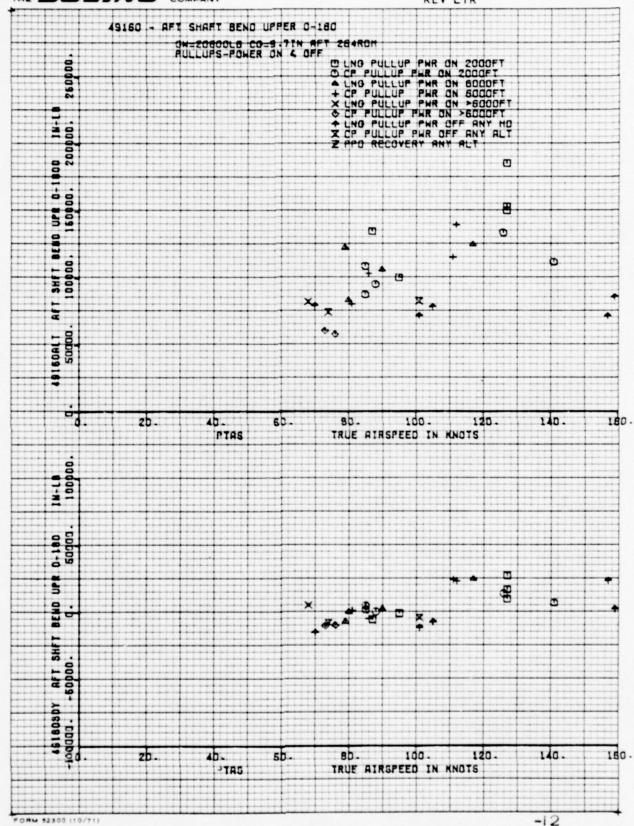


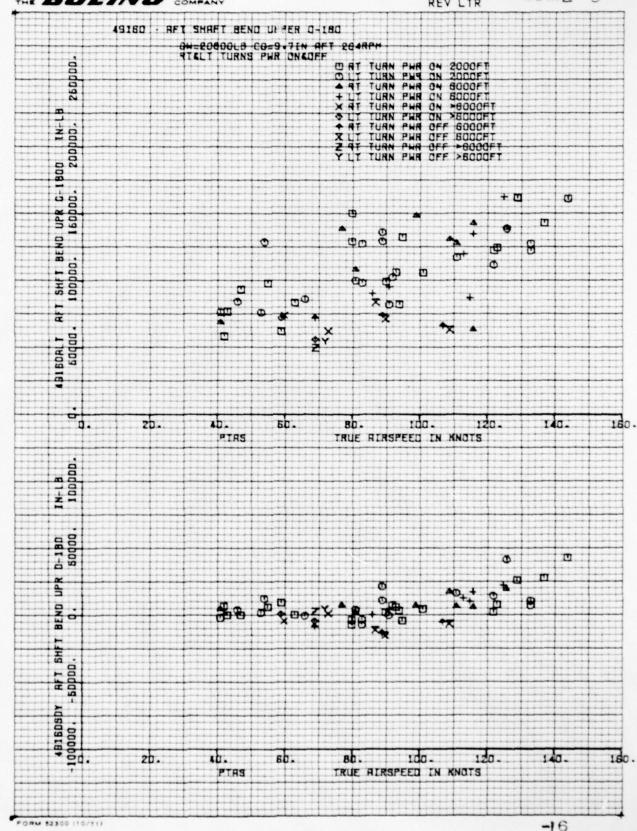


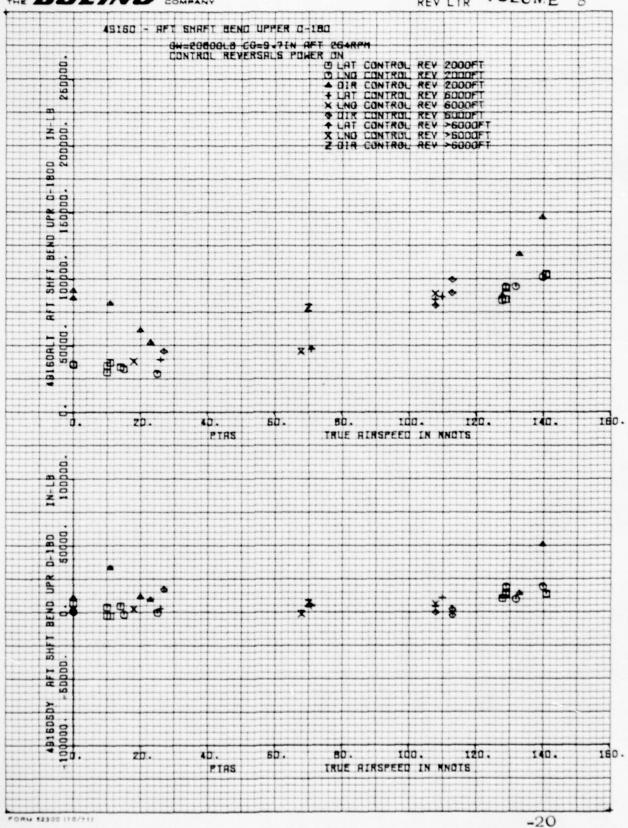
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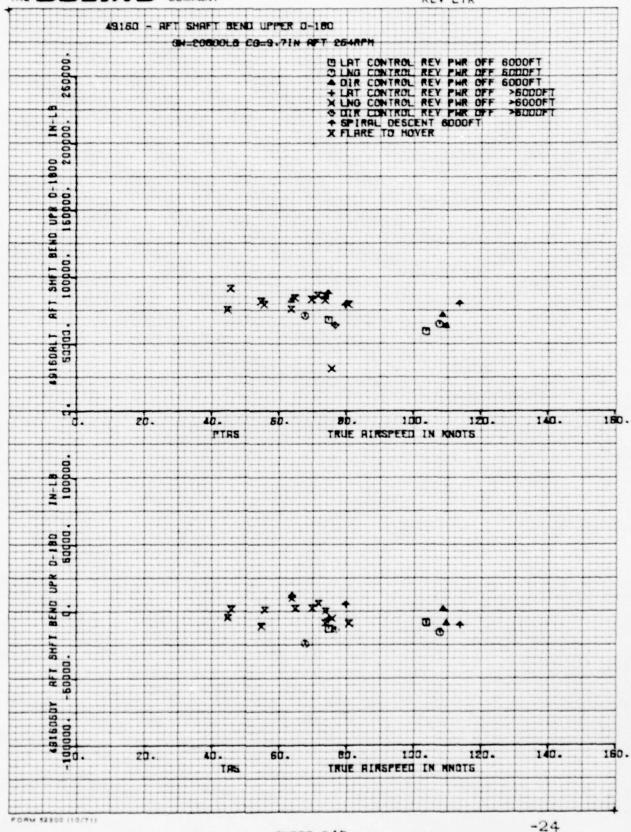
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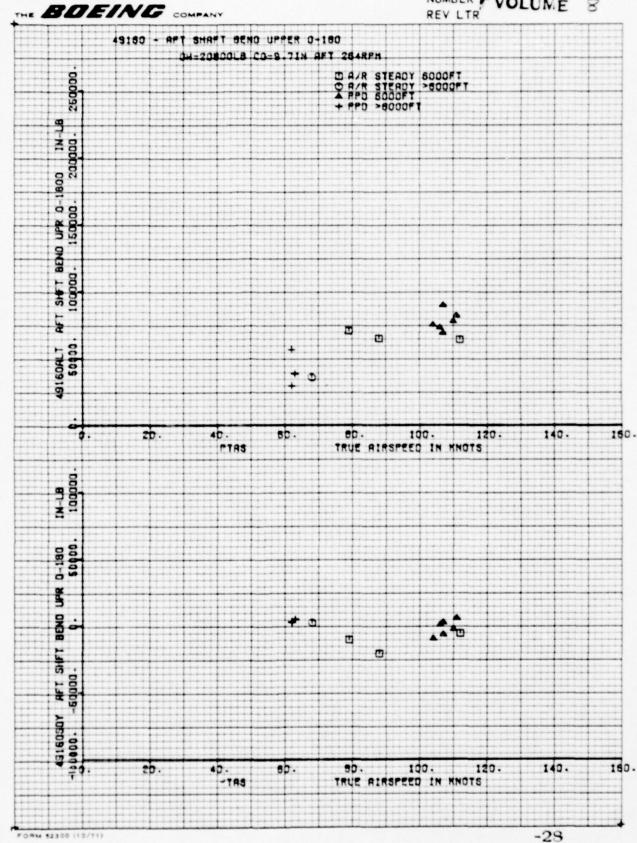


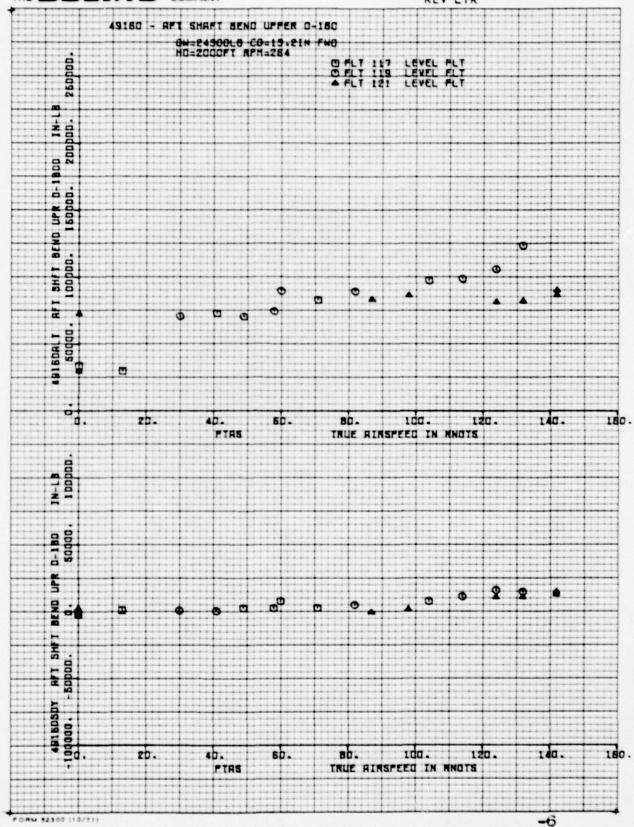












NUMBER THE BOEING COMPANY REV LTR 49160 - RET SHRET BERD UPPER 0+180 \$0-24300L8 CO-19-21N FWO 260000 OFLT 121 LEVEL FLT AFT SHFT BEND UPR D-1800 IN-LB 100000. 200000. 0 m 0 D 0 0 140. ZD. 40. 50. 8D. 100. 120. 180. TRUE RINSPEED IN KNOTS PTAS 0

80.

100.

TRUE AIRSPEED IN KNOTS

120.

180.

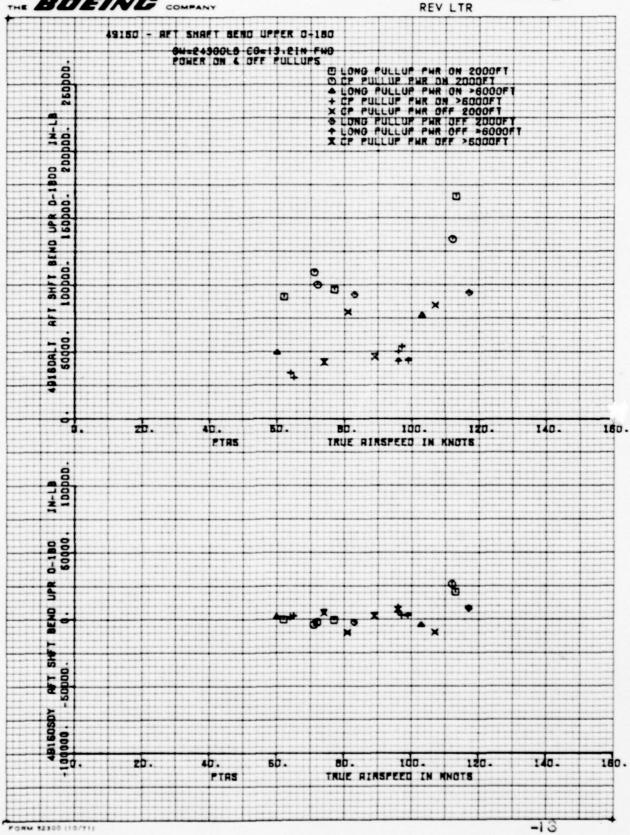
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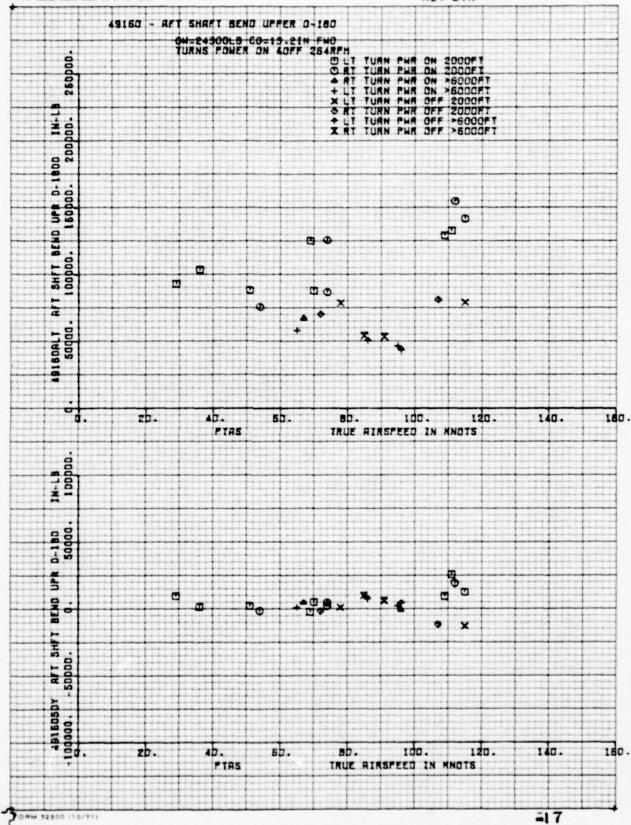
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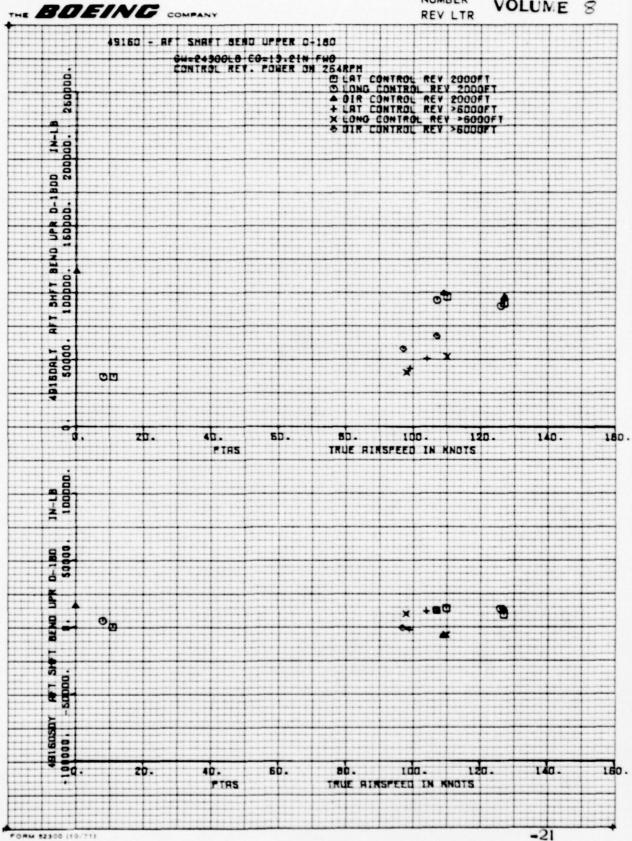
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FORM \$2300 (10/71)

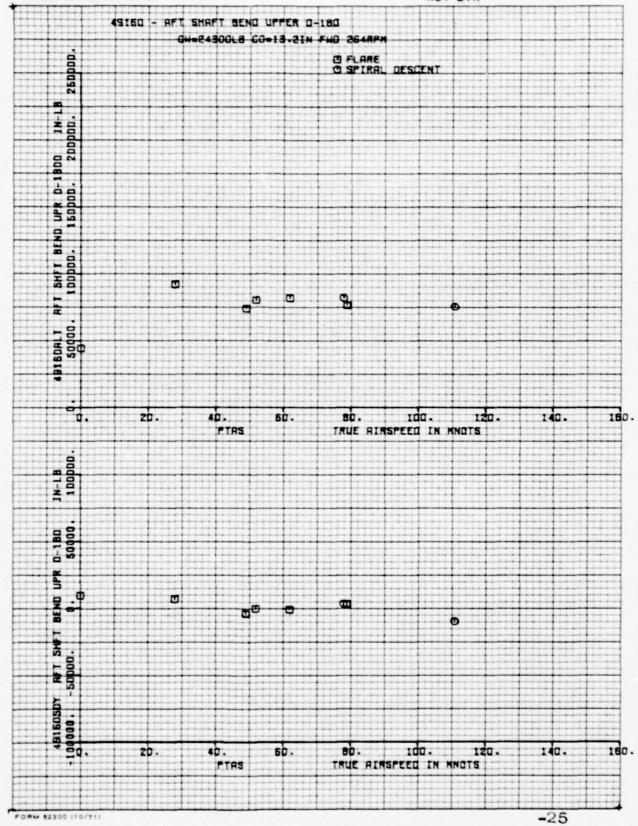
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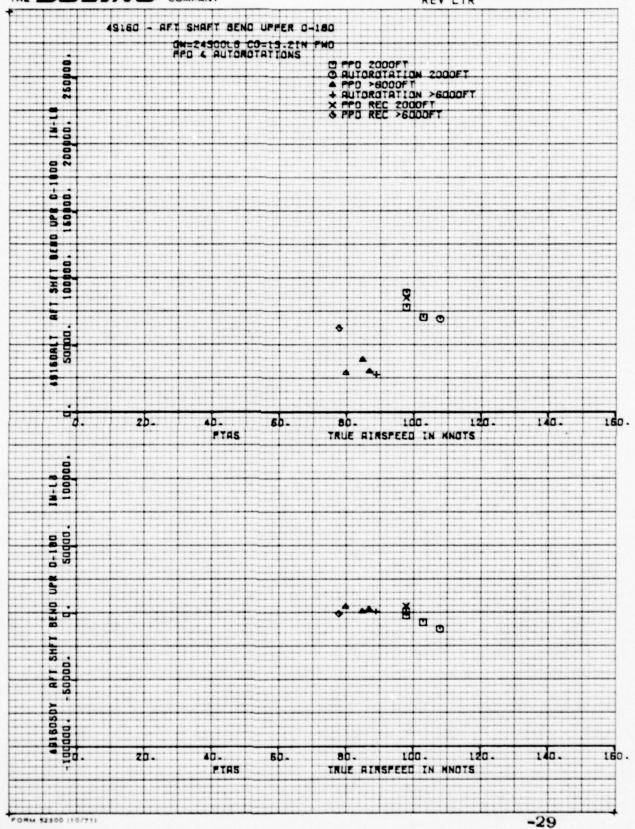




D210-111F8-3 NUMBER REV LTR VOLUME 8

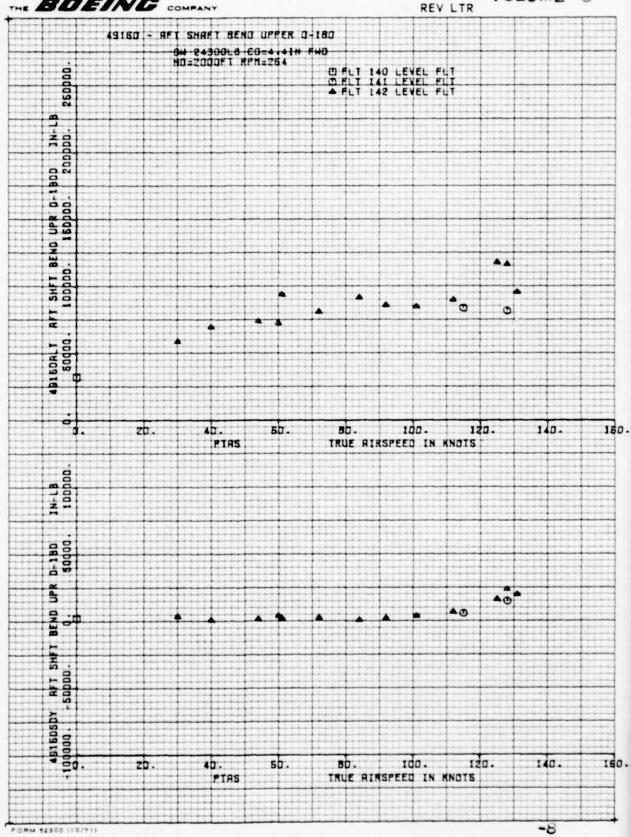


NUMBER REV LTR D210-11168-3

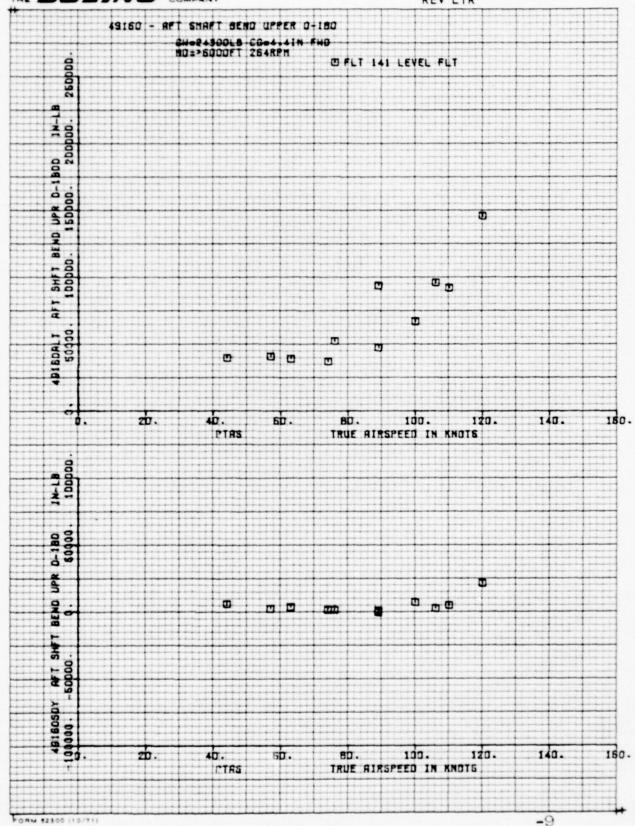


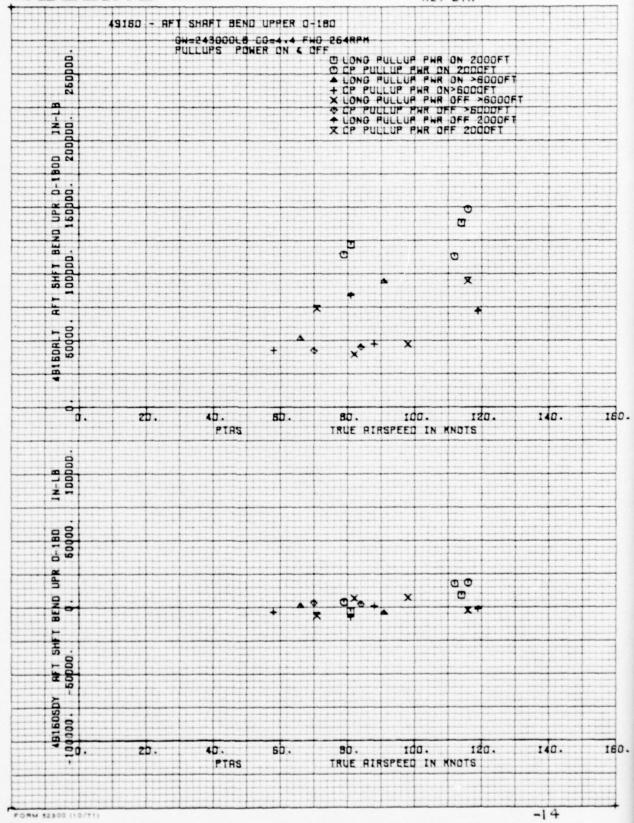
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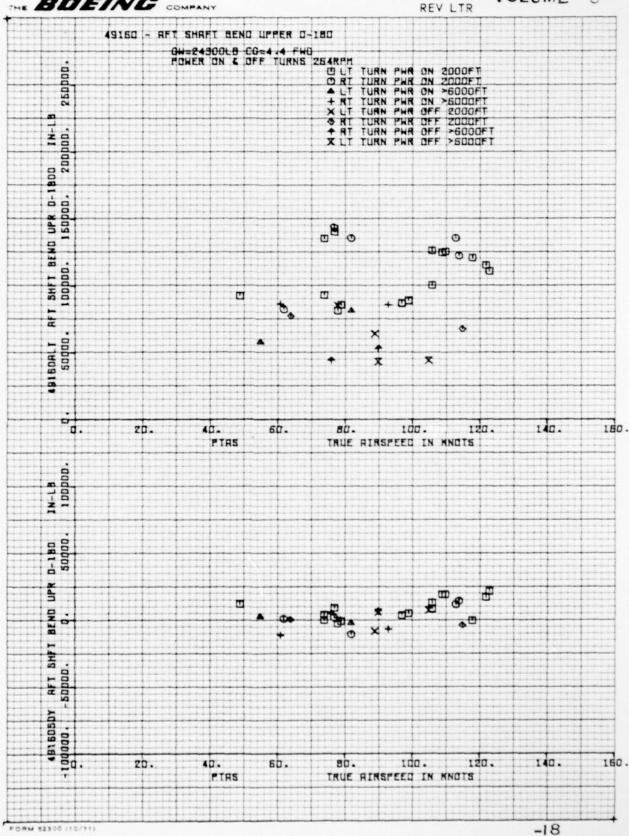


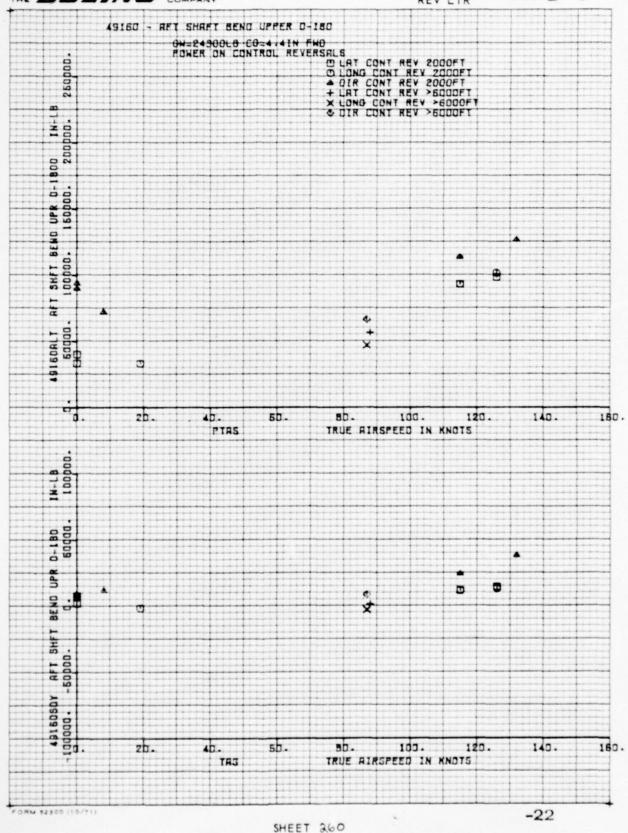
NUMBER VOLUME 8





NUMBER

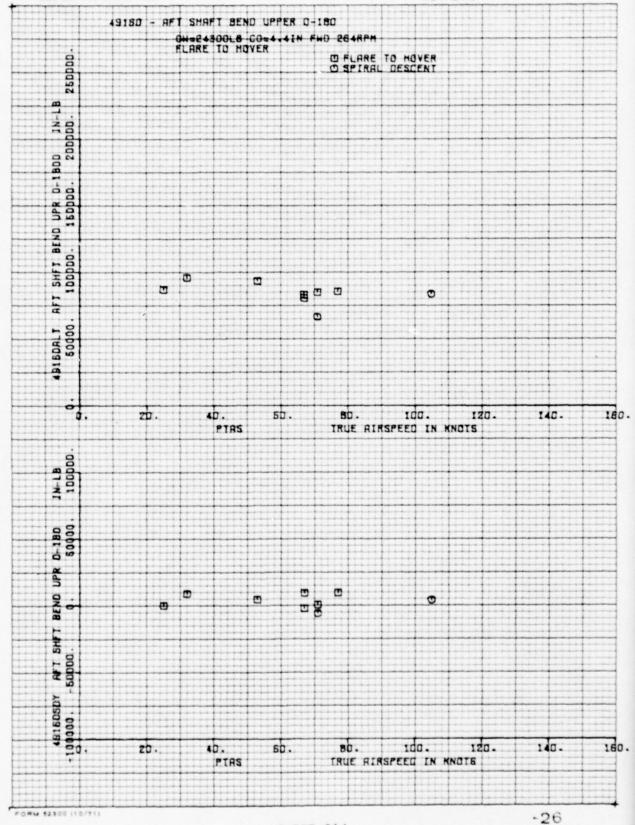




NUMBER REV LTR

THE BOEING COMPANY

4,

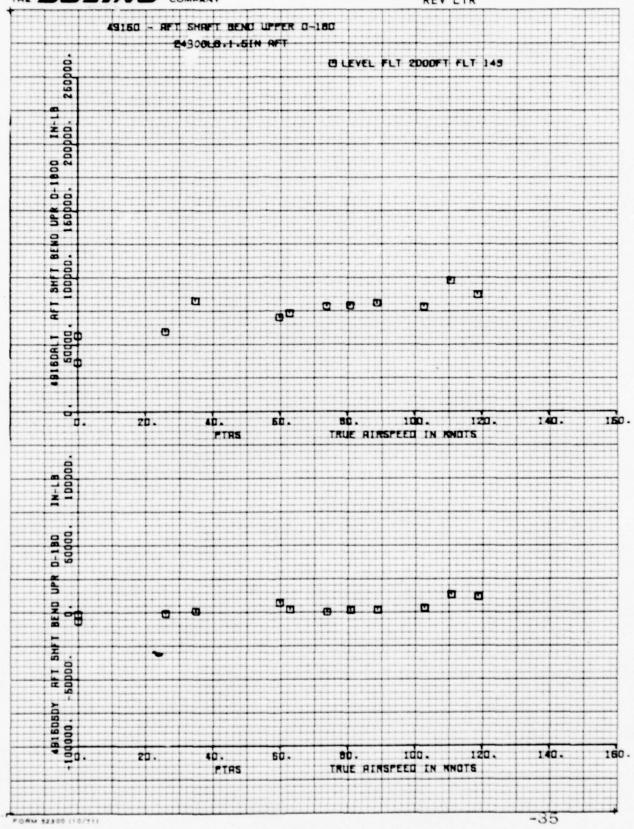


-30

THE BOEING COMPANY

FORM \$2300 (10/71)

REV LTR 49160 - AFT SHRET BEND UPPER 0-180 04 24500L8 60-4 41N FHD 264RPM ZEDDDD. D PPO 500 FPM AFT SHFT BEND UPR D-1800 IN-LB 100000. 200000. B ABIEDALT SOGOO. 0 De D 0 -d. zb. 50. Ida. 140. 150. AD. 80. TRUE RIASPEED IN MNOTS PTRS IN-LB 100000 UPK D-18D \$0000. BEND. 0 481805DY RFT 348T ida. 140. 40. 60. 80. 120. 180 . TRUE RINSPEED IN MNOTS FTAS



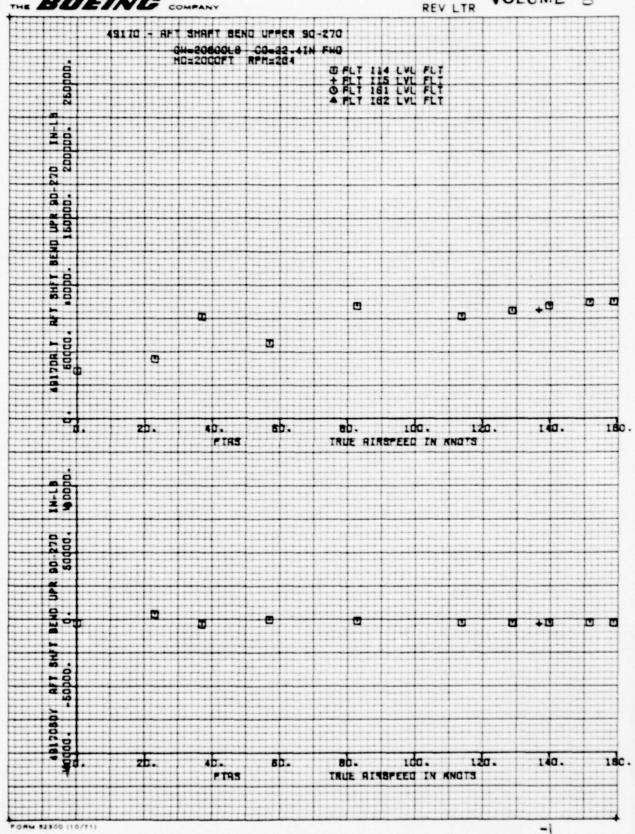
PREPARED BY: J. Bendo

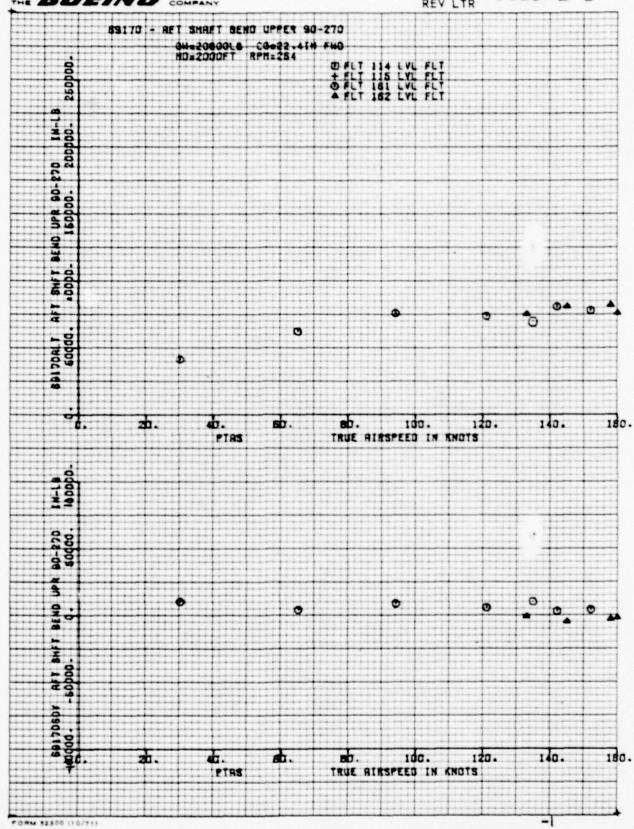
THE BOEING COMPANY DATE:

8/28/78

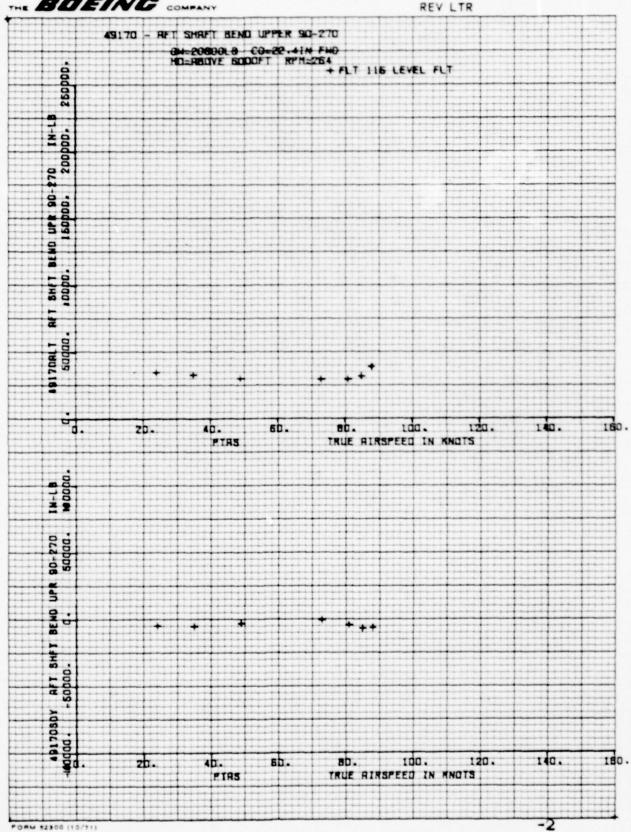
NUMBER D210-11168-3 REV LTR Volume 8 MODEL NO.

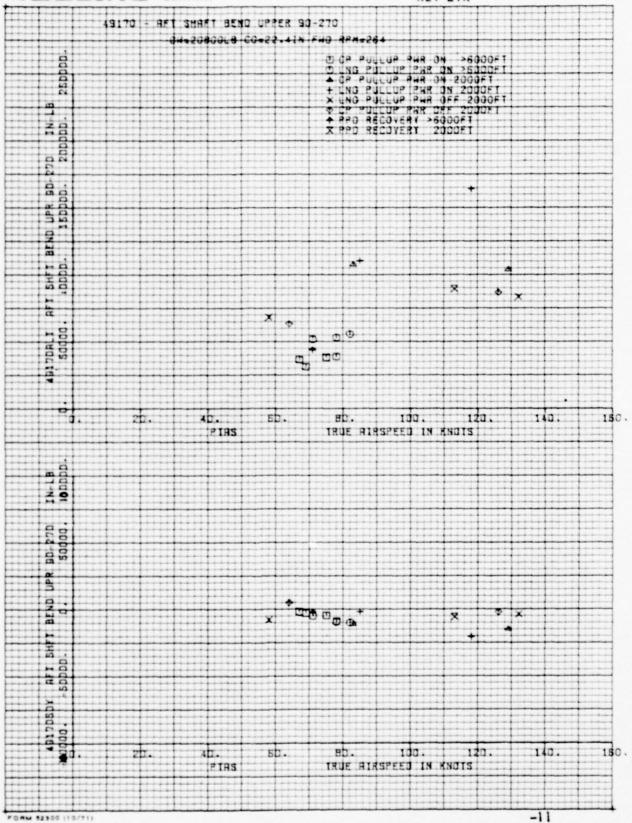
4.8 Aft Shaft Bending, Upper (90° - 270°)



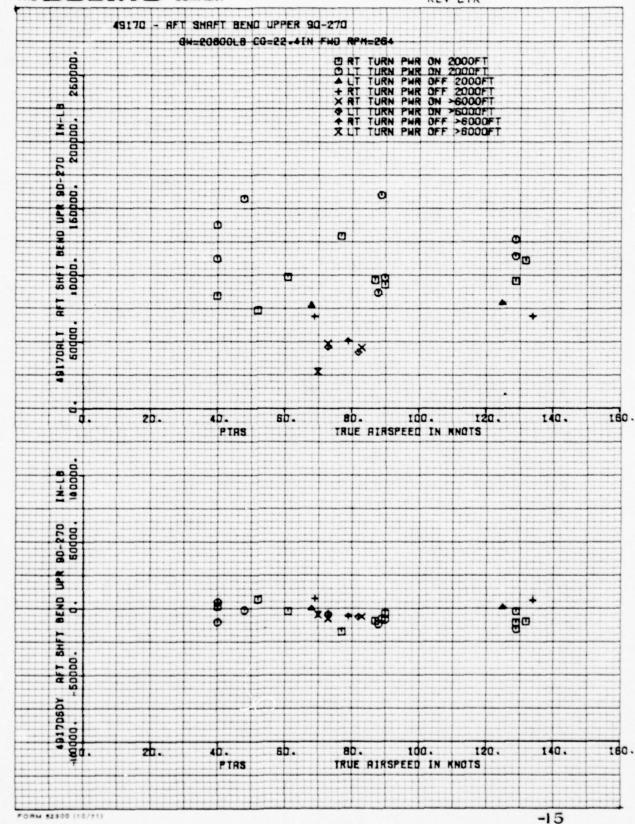


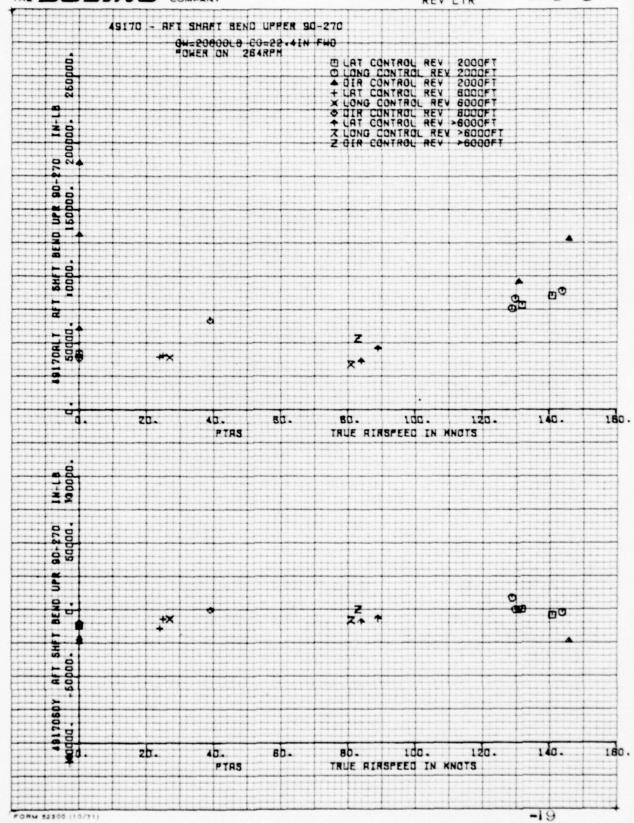
VOLUME 8 NUMBER

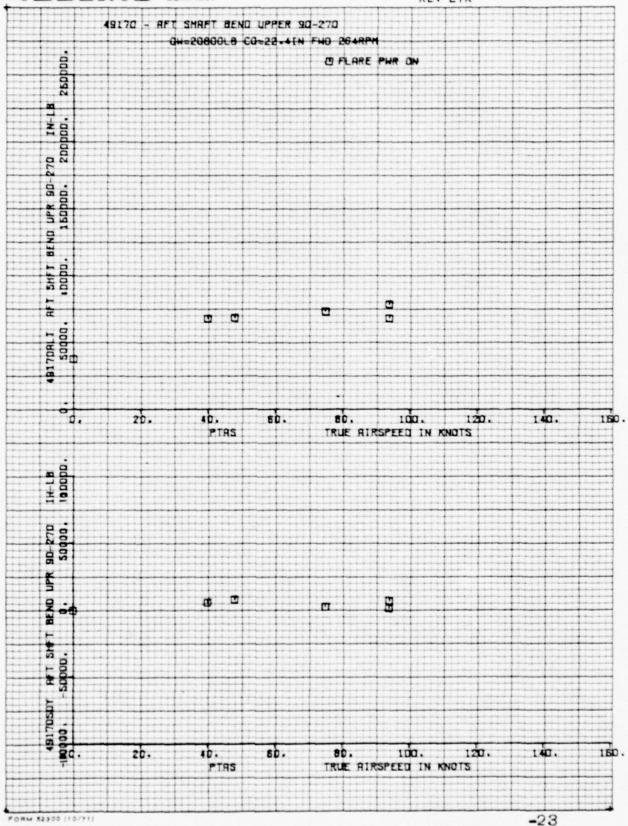




NUMBER REV LTR







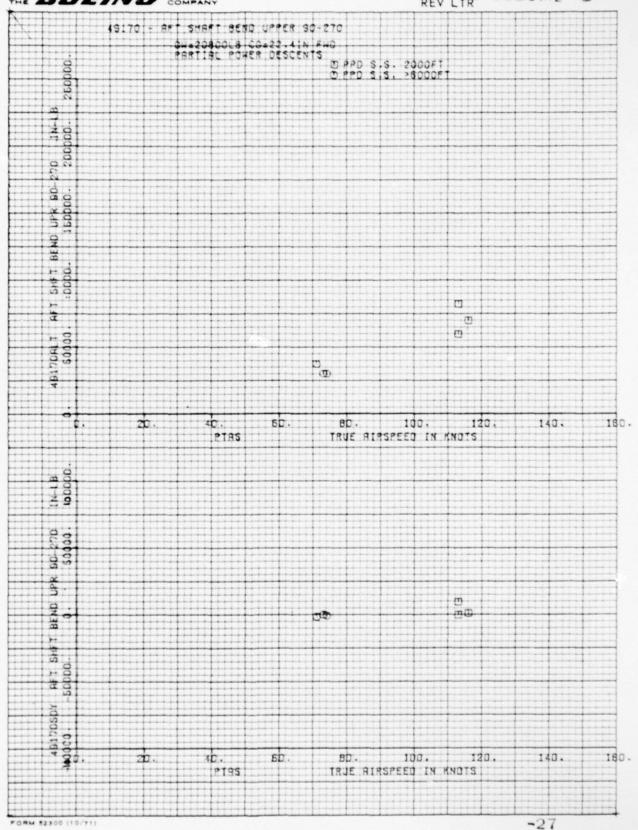
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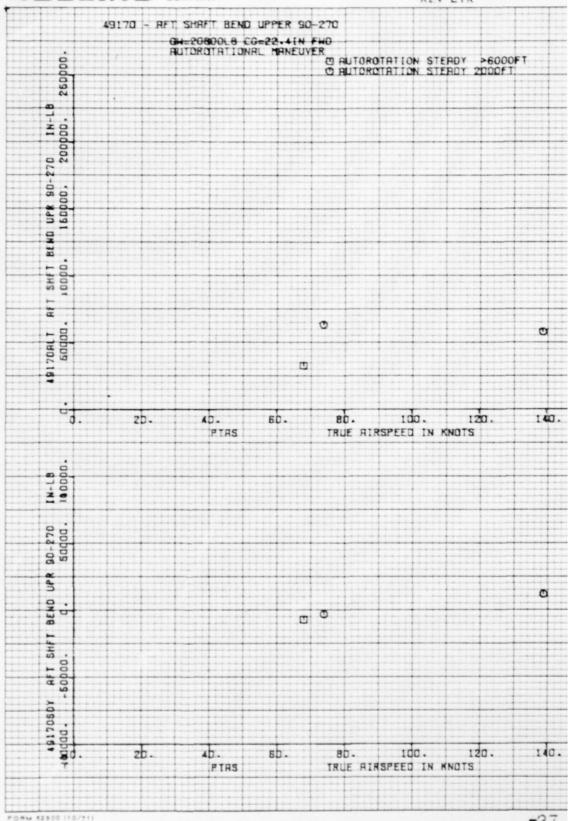
THE BOEING COMPANY

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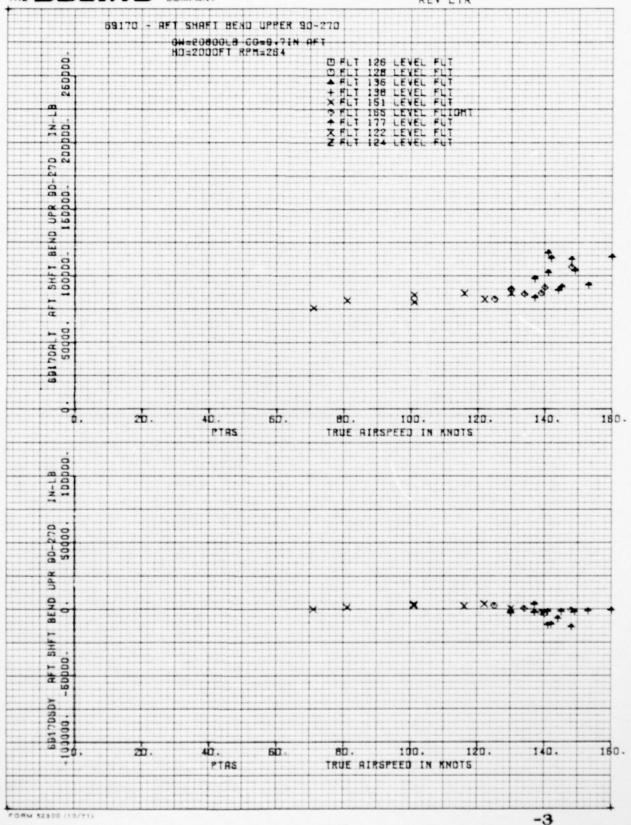
REV LTR 49170 - RFT SHRFT BEND UPPER 90-270 0H=20000L8 C0=22.4IN FHO © LAT CONTROL REV 2000FT
© LONG CONTROL REV 2000FT
♣ DIR CONTROL REV 2000FT
♣ LAT CONTROL REV >6000FT
▼ LONG CONTROL REV >6000FT
▼ DIR CONTROL REV >6000FT 250DDD. AFT SHFT BEND UPR 90-270 IN-LB 10000. 200000. Z SOOGO. 4 O 0 + 20. 100. 120. 140. 180 . 40. 80. 5D. PIAS TRUE ATRSPEED IN MNOTS INTER ISDODO 50000 ABL70SDY AFT SHFT BEND UPR 0 Z 20. 140. 120. 180. 4D. 5D. 80. 100. TRUE RIRSPEED IN MNOTS PTAS FORM \$2300 (10/71) -23





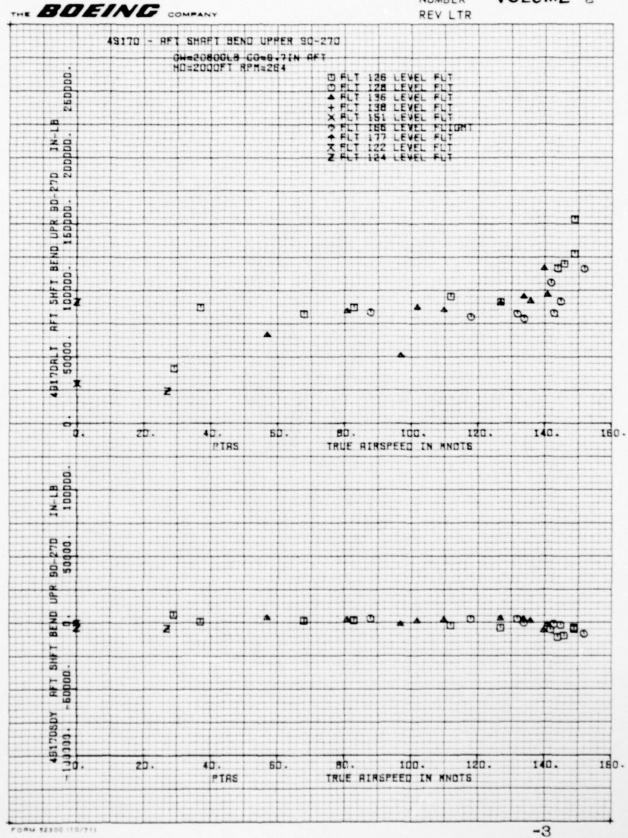


VOLUME 8 NUMBER REV LTR

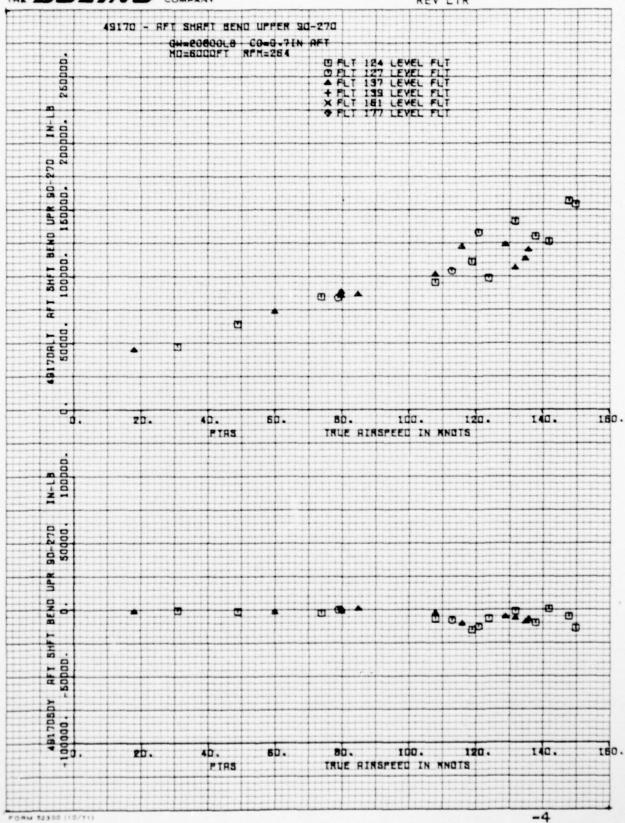


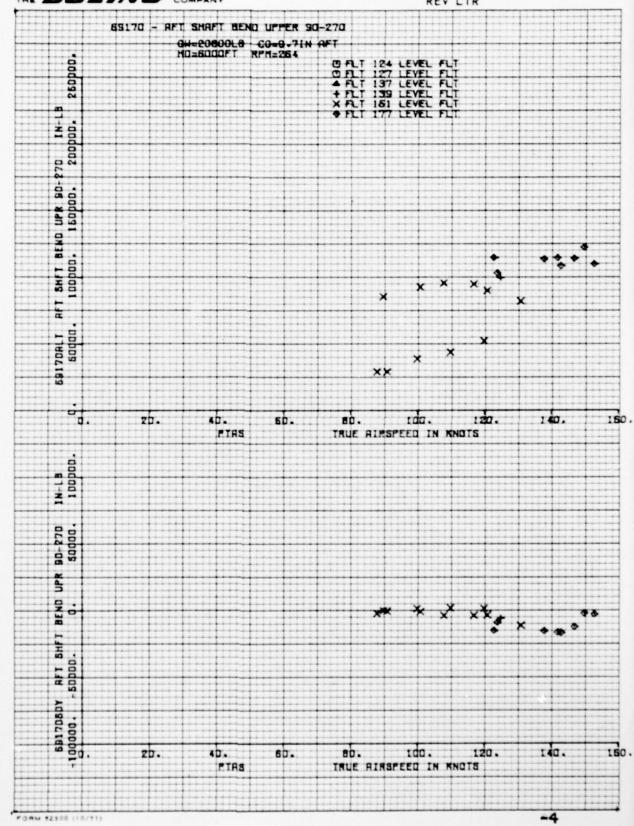
VOLUME 8

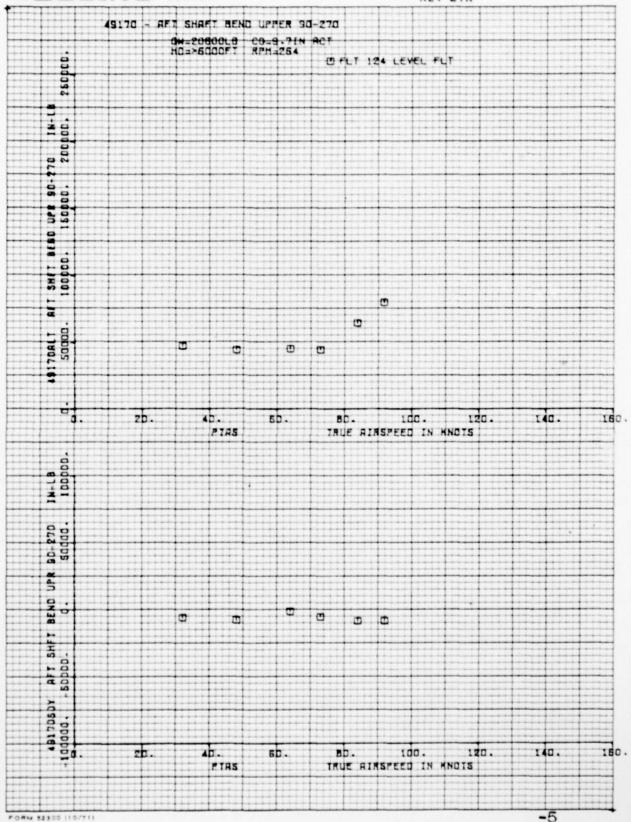
NUMBER REV LTR



NUMBER VOLUME 8

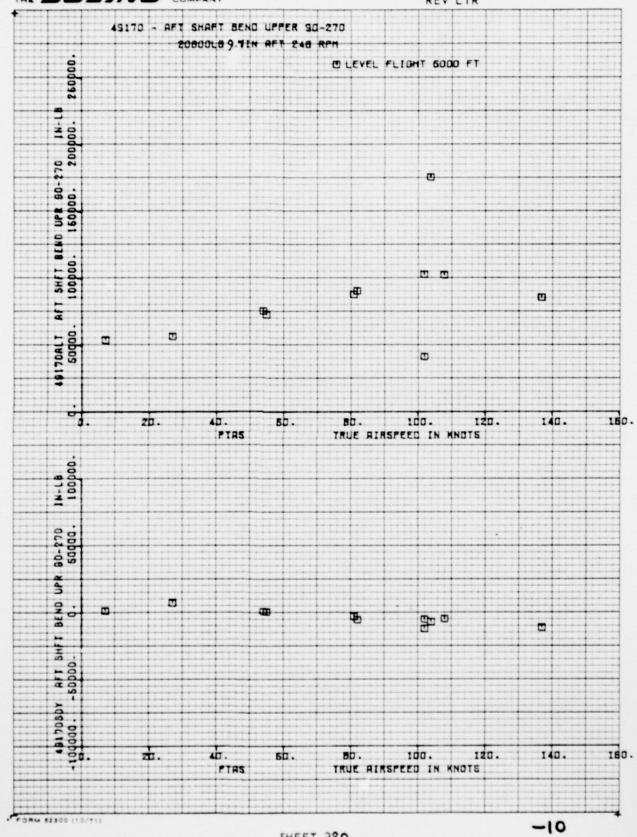


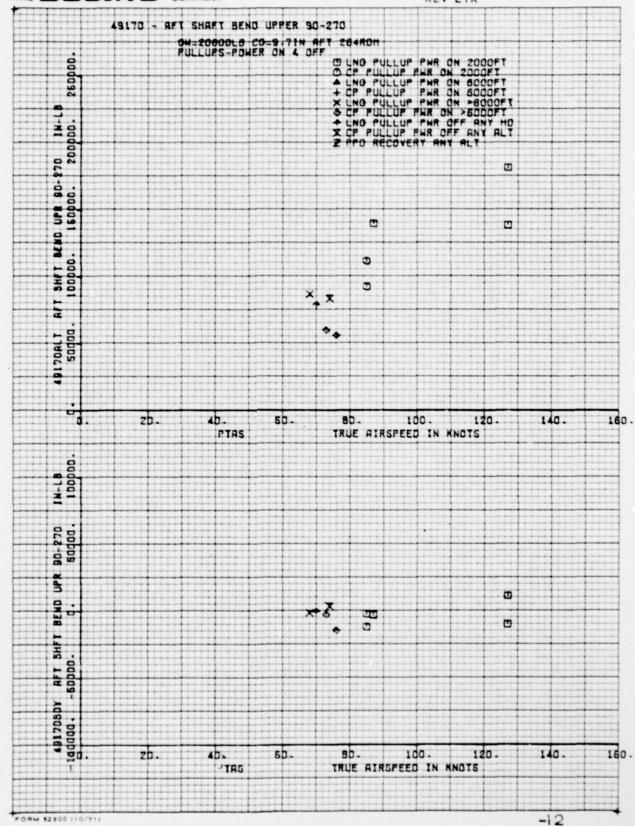




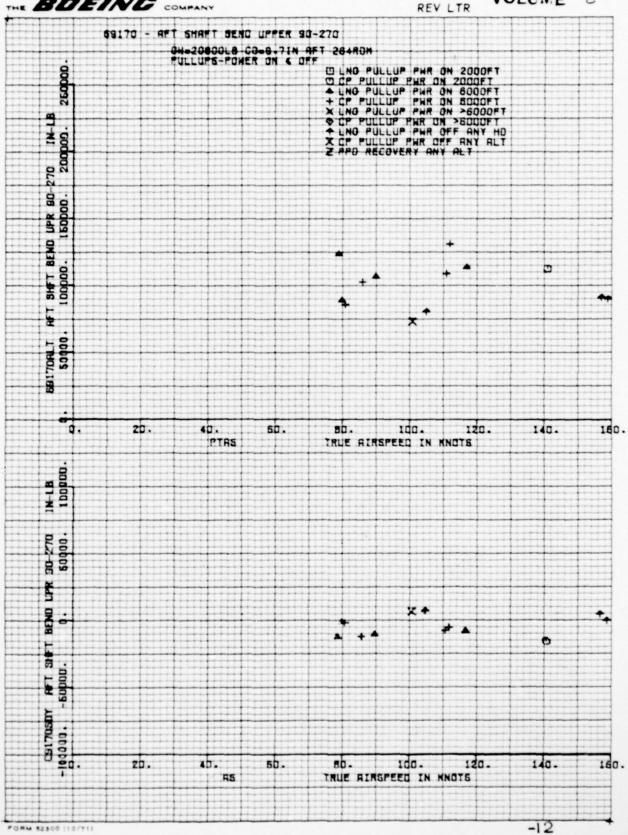
THE BOEING COMPANY

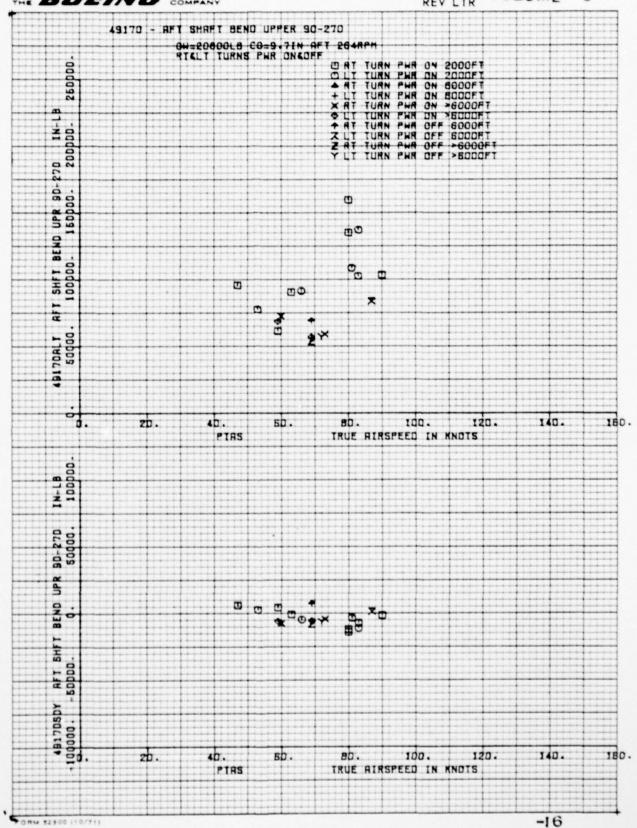
NUMBER REV LTR



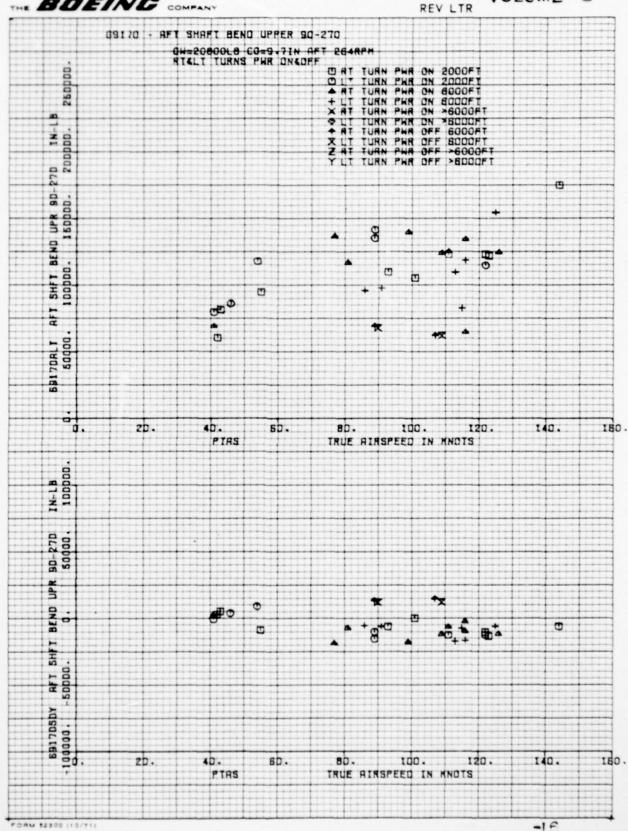


NUMBER





NUMBER



NUMBER | VOLUME 8

THE BOEING COMPANY

FORM \$2300 (10/71)

REV LTR 49170 - RET SHRET BEND UPPER 90-270 CHECOGOGLO CO-9-71N AFT 264RPM R DN

9 LAT CONTROL REV 2000FT

0 LNG CONTROL REV 2000FT

4 DIR CONTROL REV 2000FT

+ LAT CONTROL REV 6000FT

X LNG CONTROL REV 6000FT

9 DIR CONTROL REV 6000FT

X LNG CONTROL REV 5000FT

X LNG CONTROL REV >6000FT

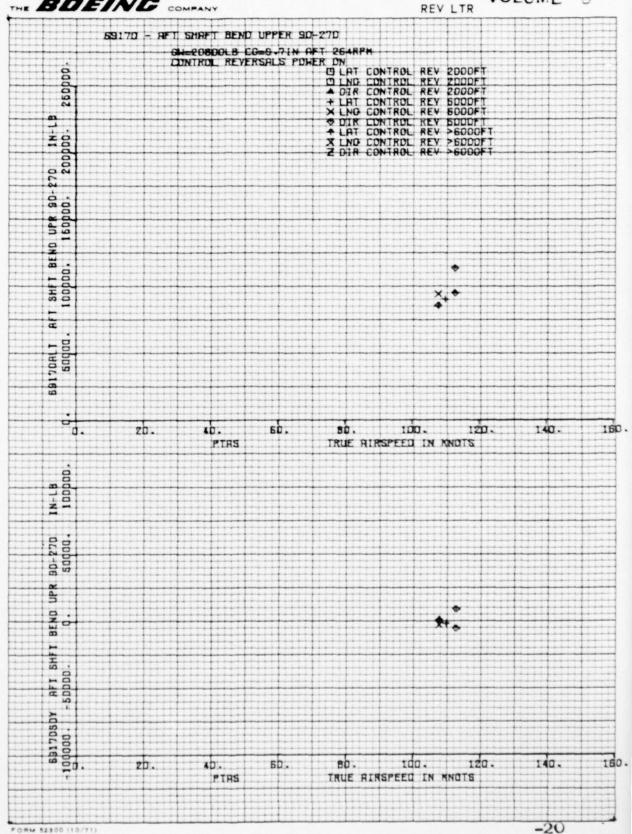
X LNG CONTROL REV >6000FT

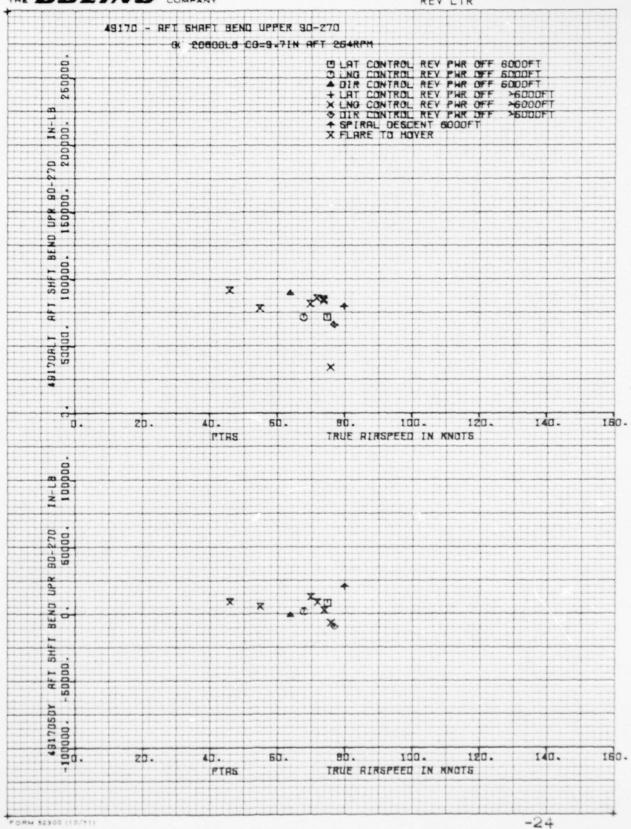
Z DIR CONTROL REV >6000FT m I SHFI BEND UPR 90-270 IN-1 100000. 150000. 200000. AFT. .9170ALT S0000 文字 # ex ida. 140. 160. 80. ZD. AD. TRUE RIRSPEED IN MNOTS PIRS 100000. 80-27D \$0000. BEND UPR 0 DY AFT SHFT B 4917DSDY -100000. 140. 180. 4D. 100. 20. TRUE ALASPEED IN MNOTS PTAS

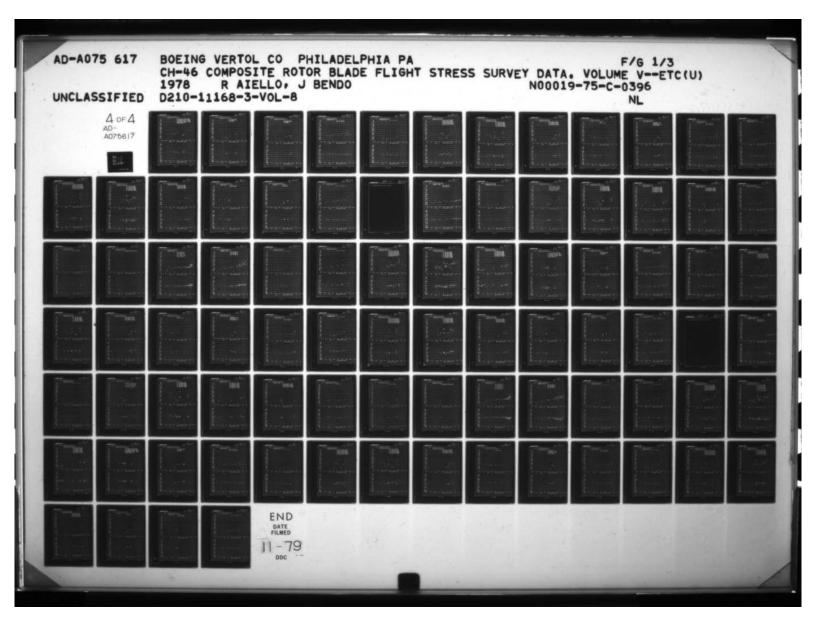
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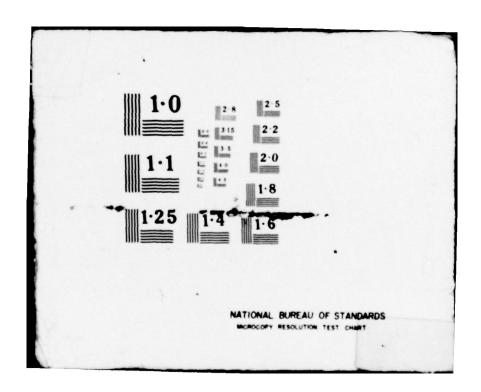
THE BOEING COMPANY

W. D

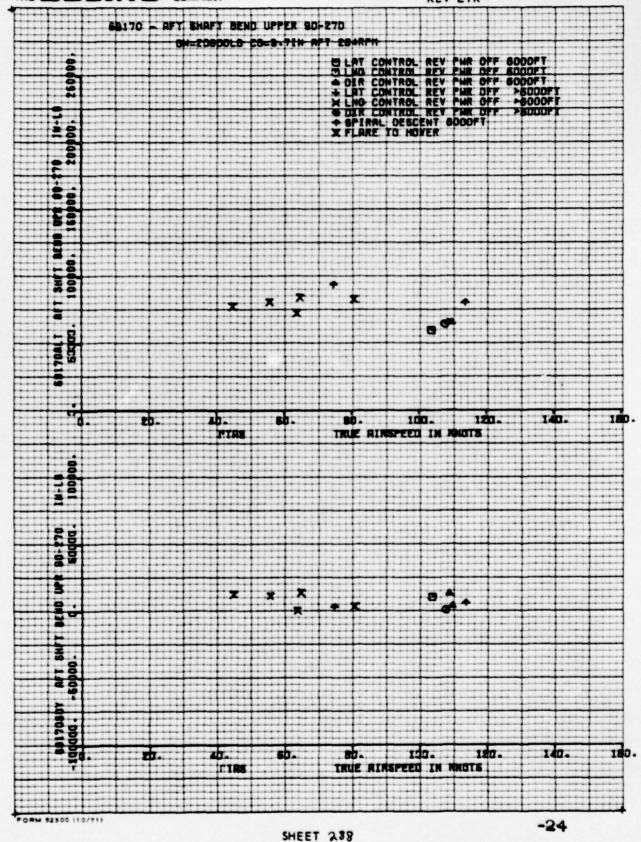








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D210-11168-3 NUMBER! VOLUME 8

THE BOEING COMPANY REV LTR 88170 - RET SHRET BENG UPPER SQ-270 20000LB CO-0 7IN ATT 264RP B A/R STEADY SOCOFT
B R/R STEADY > 6000FT
A PPO 6000FT
+ PPO > 6000FT 0 10 20. 80. 80. 100. 120. 180. TRUE ALRSPEED IN MNOTS PTAR

20.

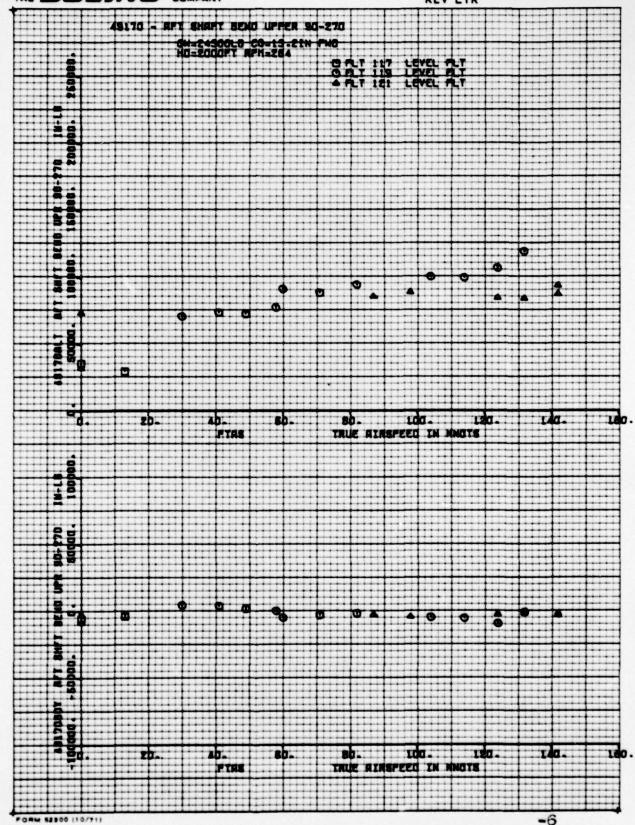
FORM \$2300 (10/71)

SD.

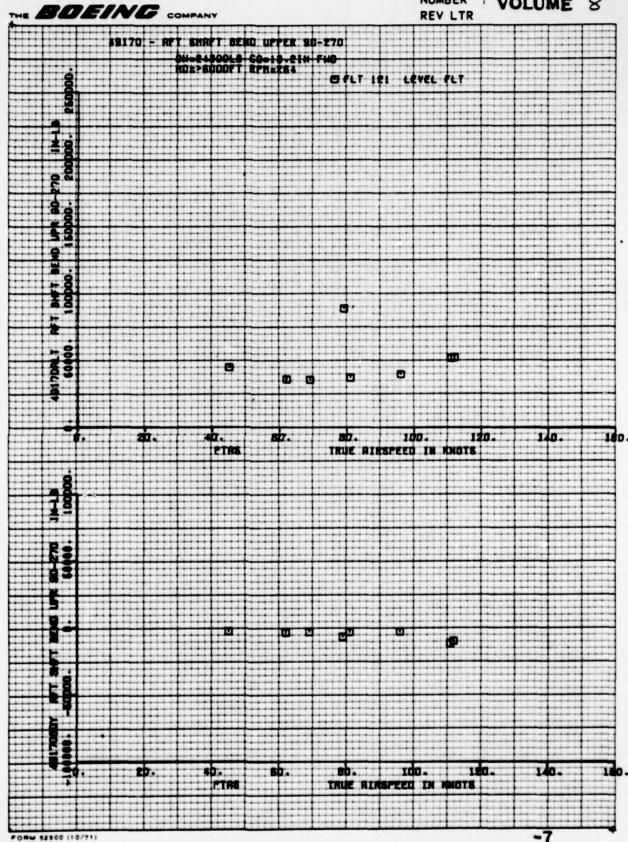
ab. 100- 1 TRUE AIRSPEED IN KNOTS 140.

-28

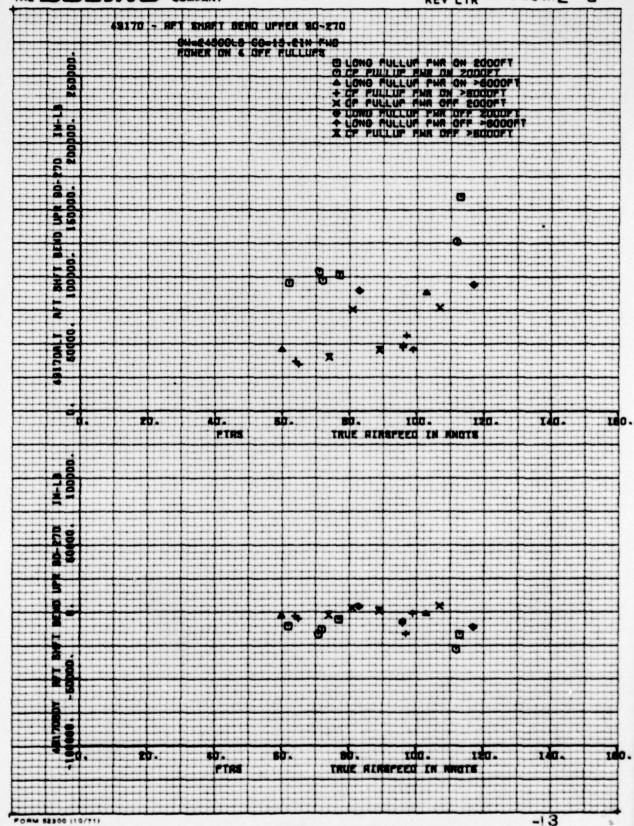
100.

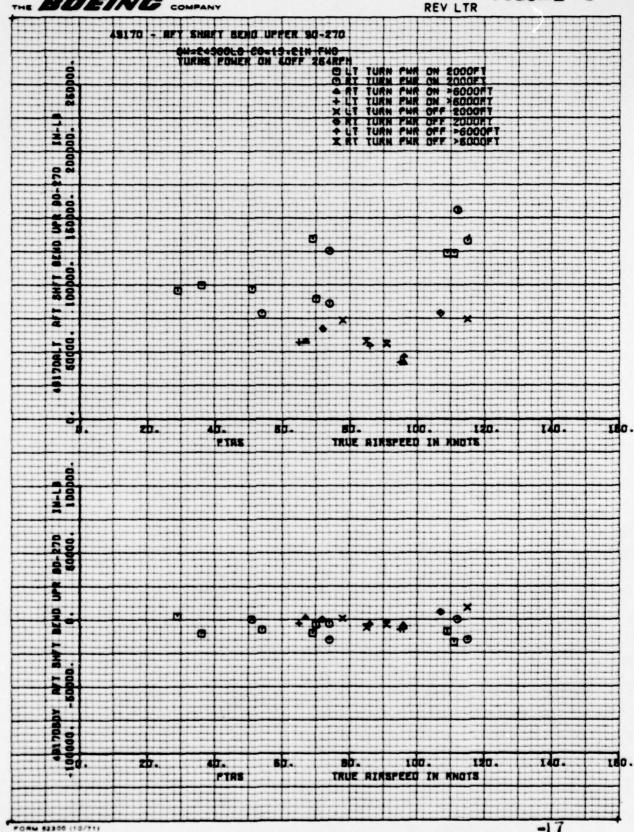


· D210-11168-3 NUMBER | VOLUME 8 REV LTR OFLT IEL LEVEL FLT 0 SD. 100. 120. TRUE AIRSPEED IN KNOTS

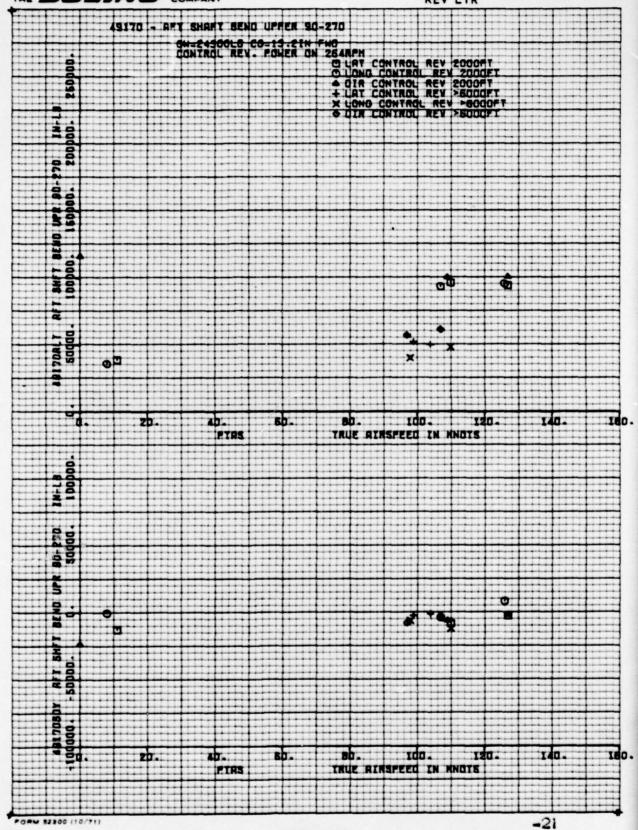


SHEET 292





THE BOEING COMPANY

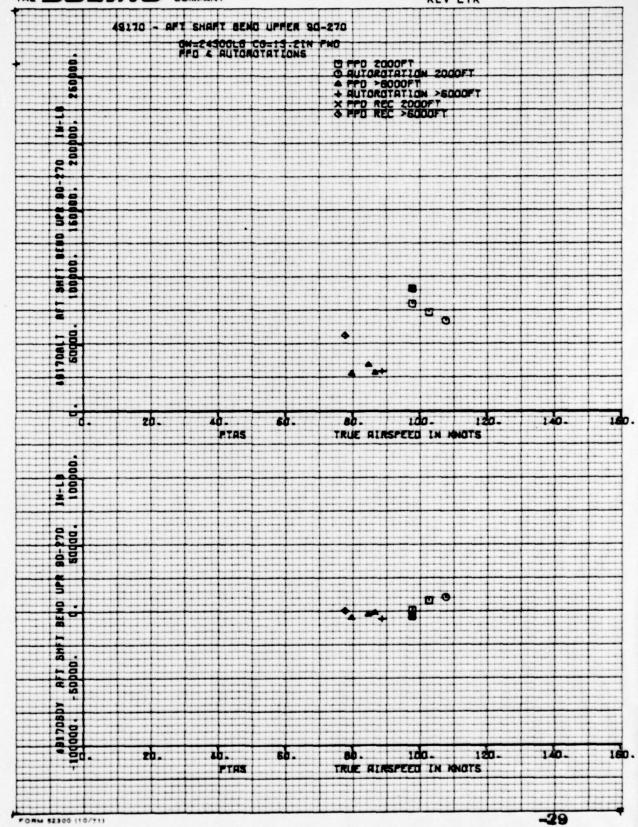


D210-11168-3 NUMBER VOLUME 8

BOEING COMPANY REV LTR 49170 - AFT SHAFT BEHO UPPER 90-270 04-24400L8 G0-14-EIN FUD 464RPM O FLARE DESCENT 40. 80. IQQ. 12Q. 20. IBO. TRUE RINSPEED IN MNOTE FIRS Ida. 140. PTAS TRUE RINSPEED IN HNOTE -25 FORM \$2300 (10/71)

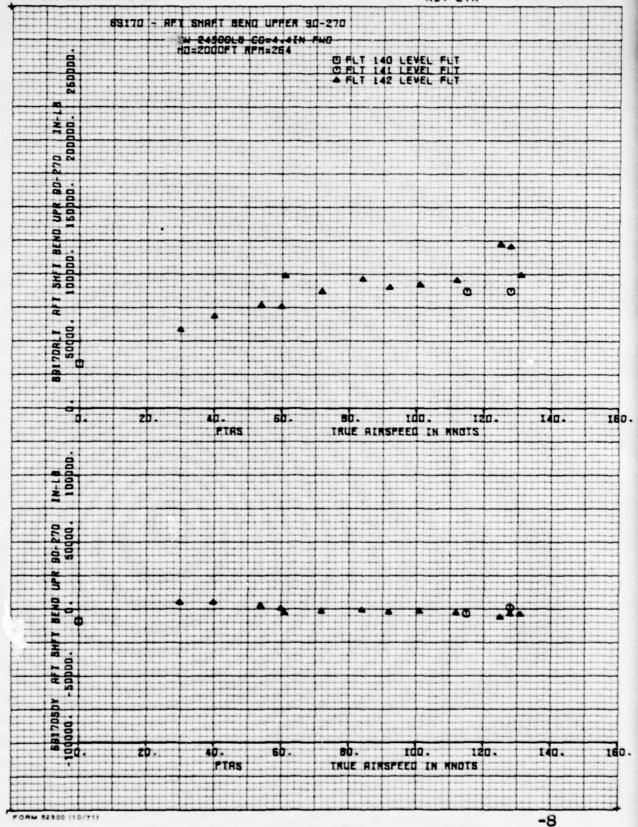
THE BOEING COMPANY

NUMBER REV LTR

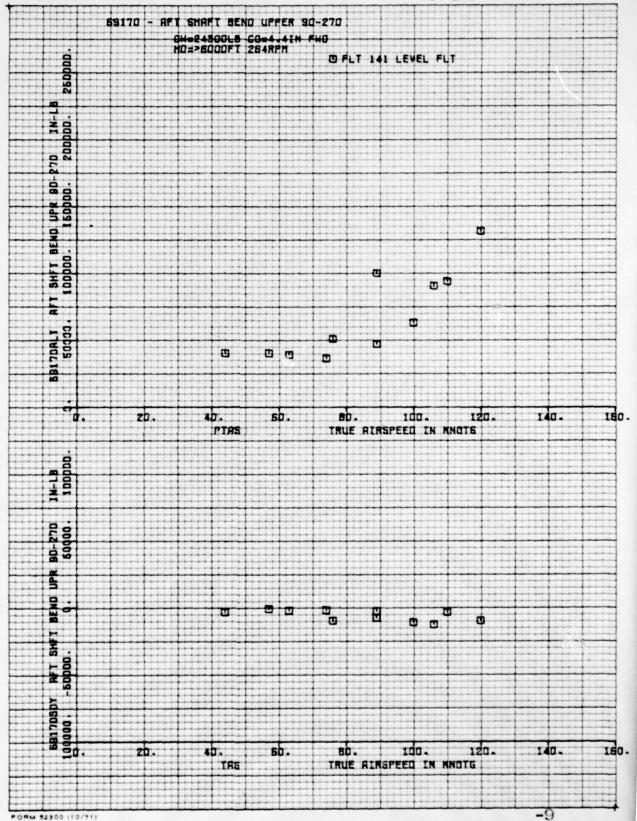


NUMBER POLITIES -3 VOLUME 8

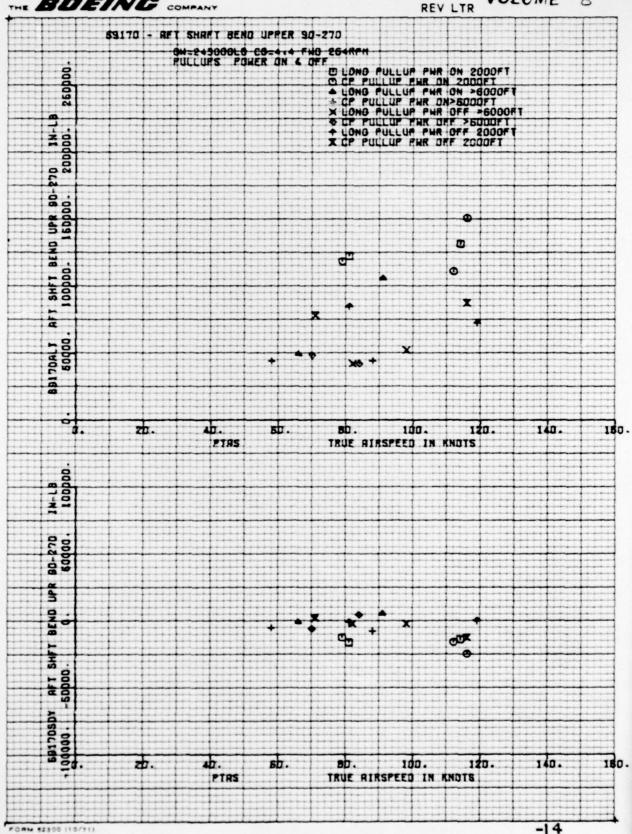
THE BOEING COMPANY

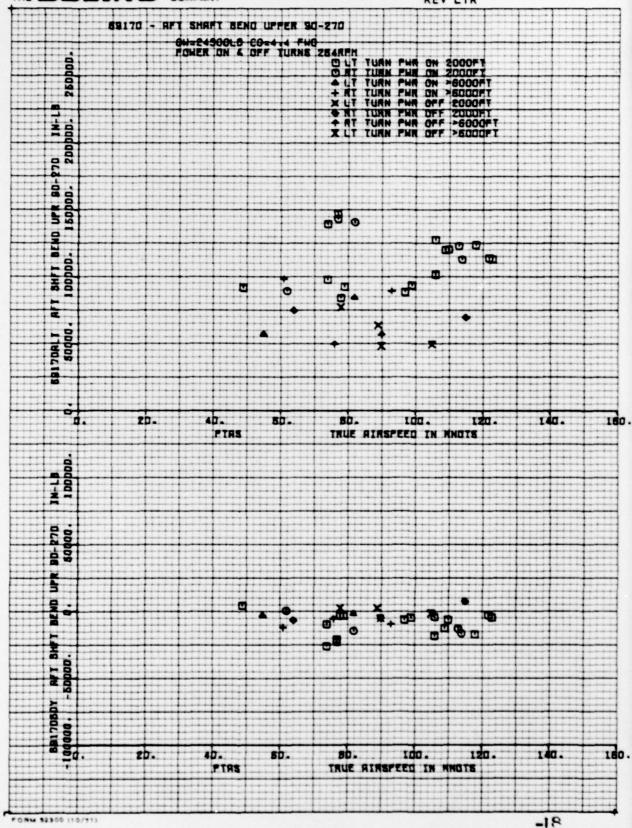


NUMBER REV LTR

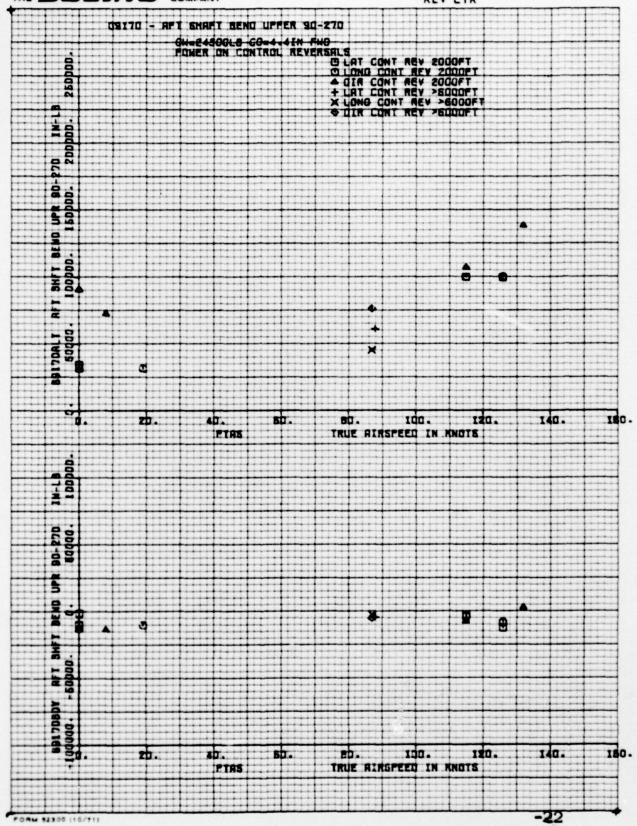


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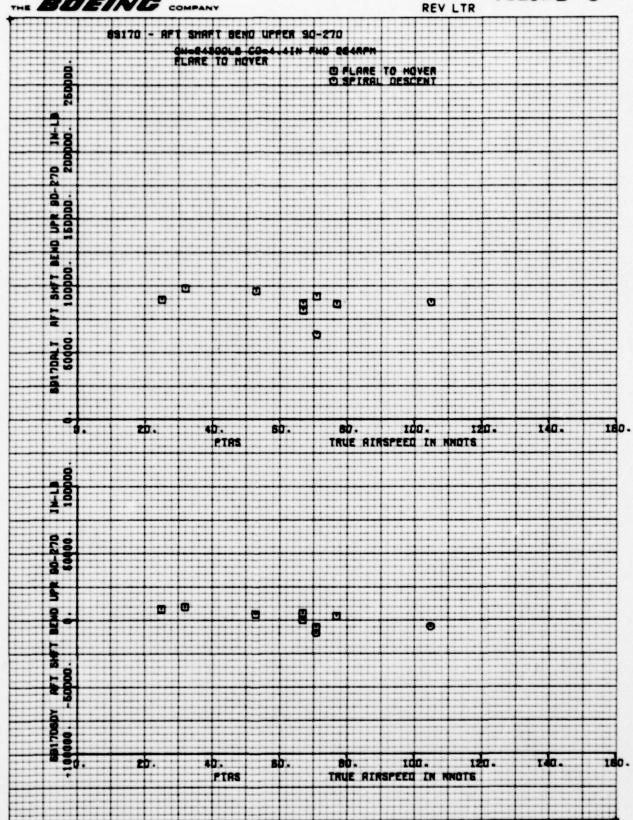


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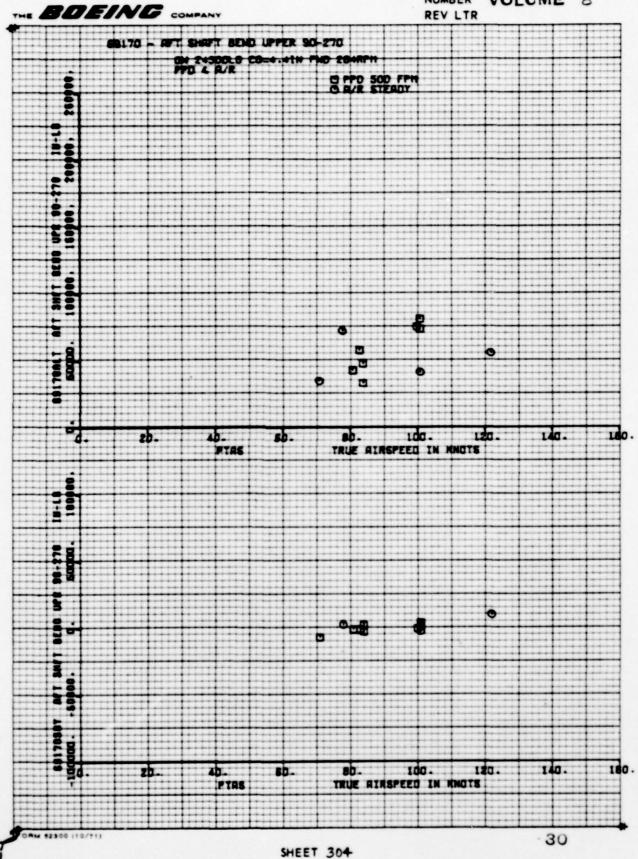


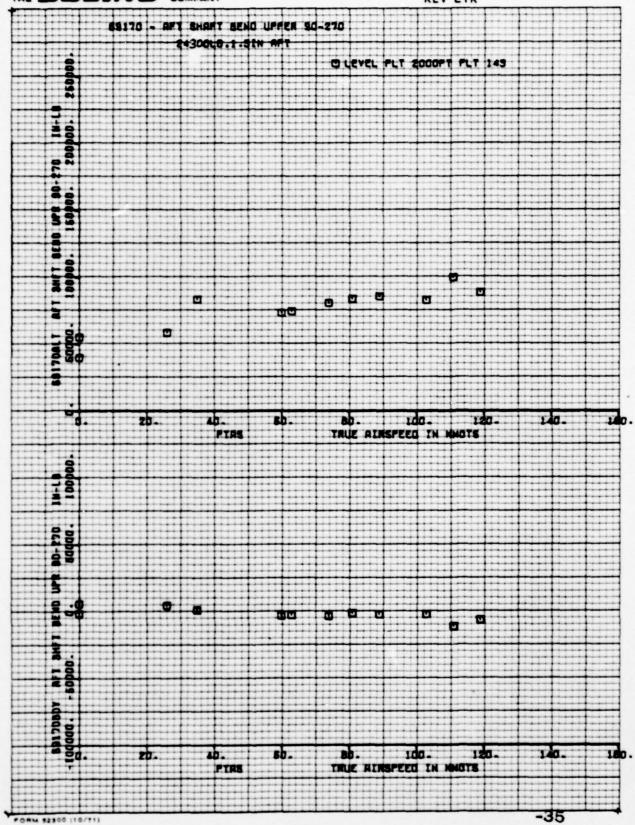
THE BOEING COMPANY

FORM \$2300 (10/71)



NUMBER VOLUME 8





PREPARED BY: J. Bendo

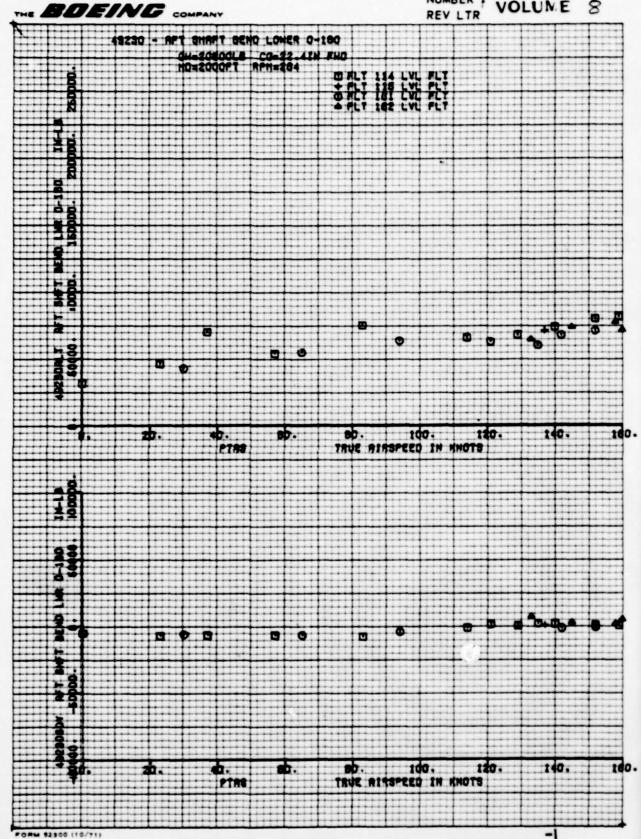
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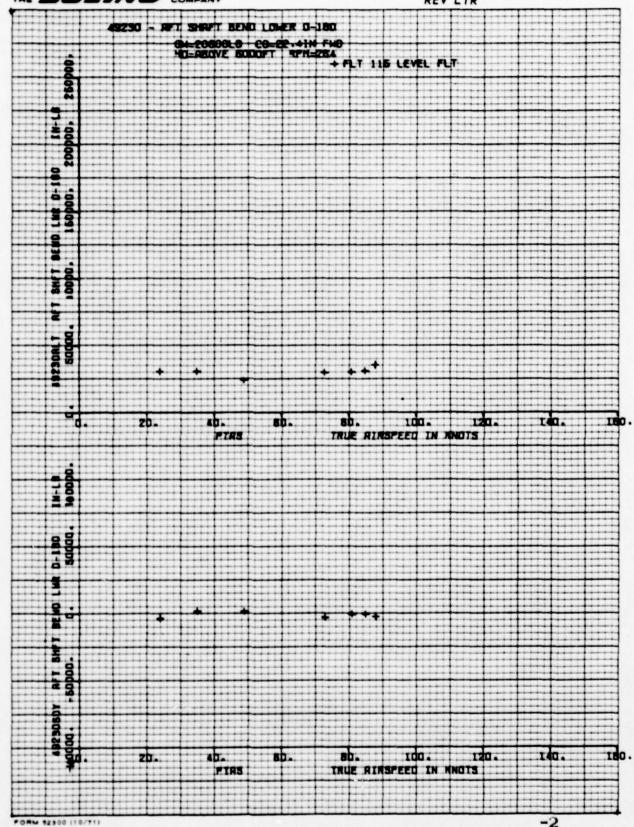
8/28/78

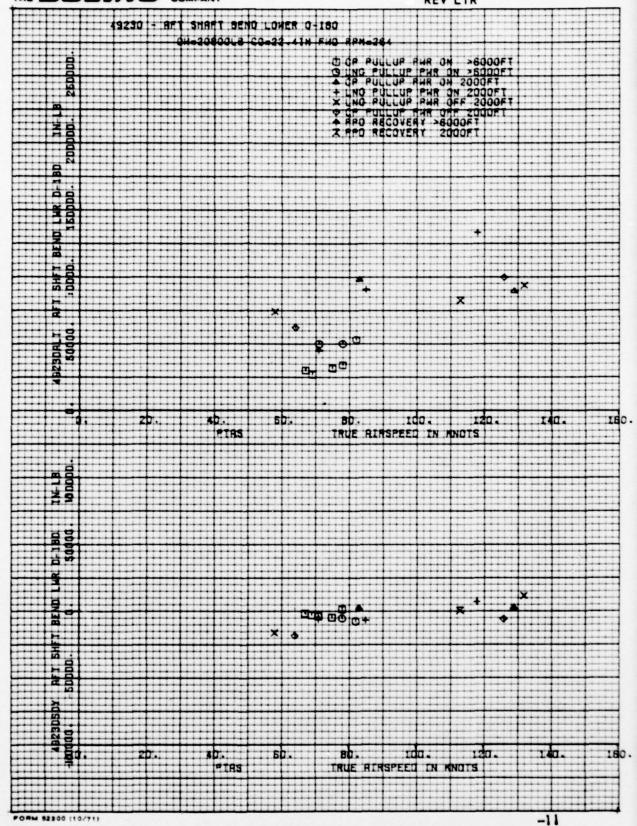
NUMBER D210-11168-3 REV LTR Volume 8 MODEL NO.

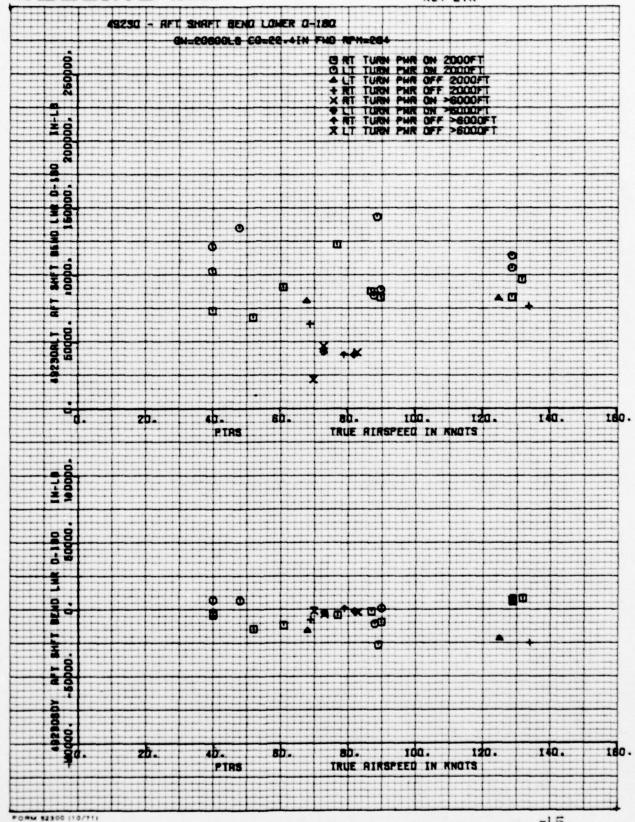
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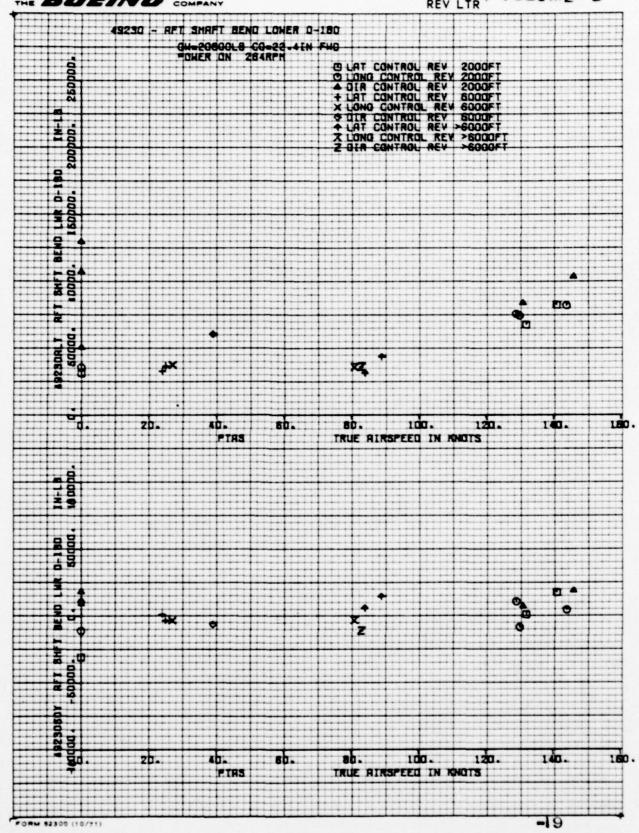
4.9 Aft Shaft Bending, Lower (0° - 180°)

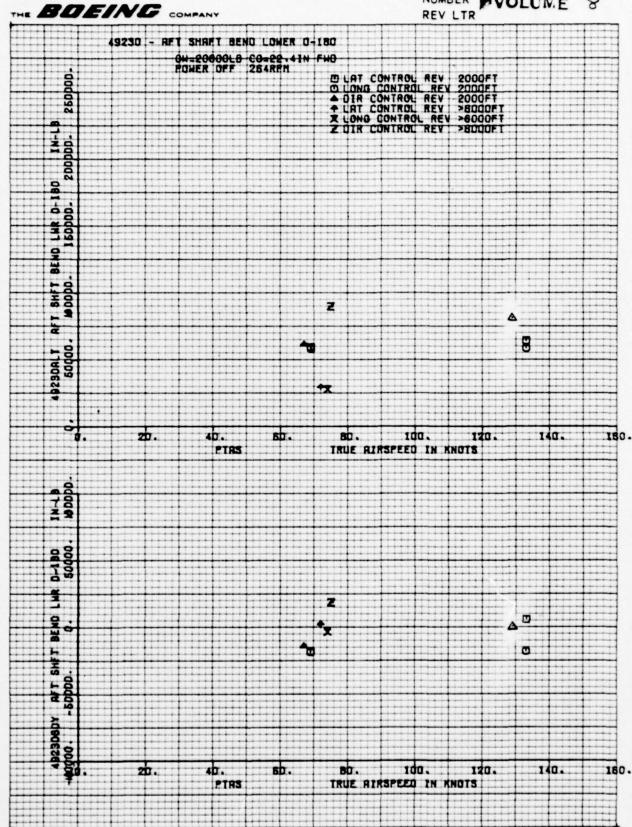




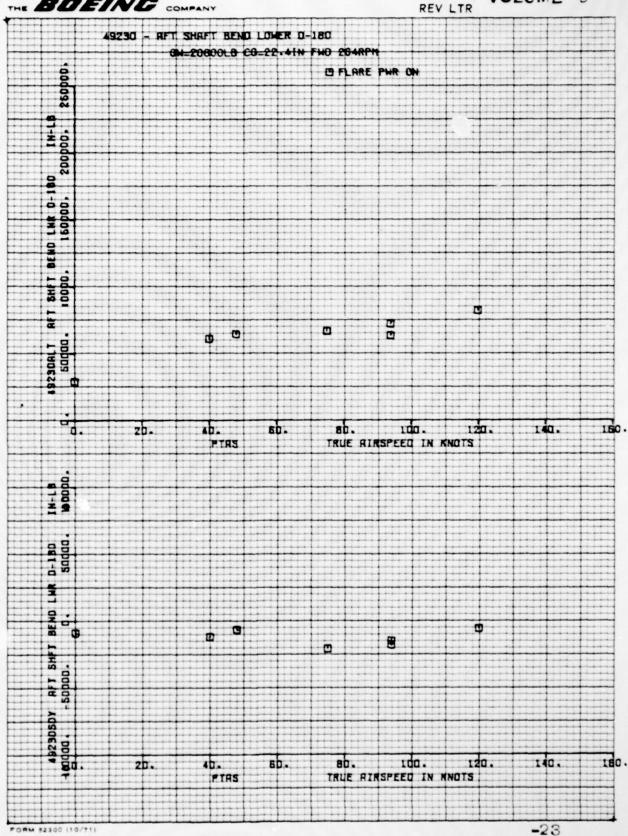








FORM \$2300 (10/71)



THE BOEING COMPANY REV LTR 49230 - AFT SHAFT BEND LOWER 0-180 T SHART BEND LOTE:

DW-20800LB CO-22.41N EHD

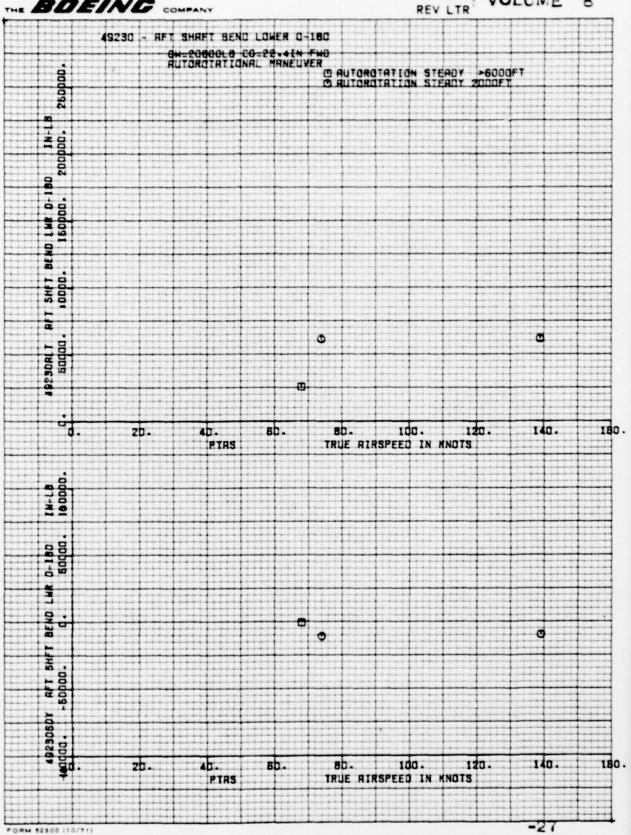
HARTIAL POWER DESCENTS

D APD S.S. 2000FT

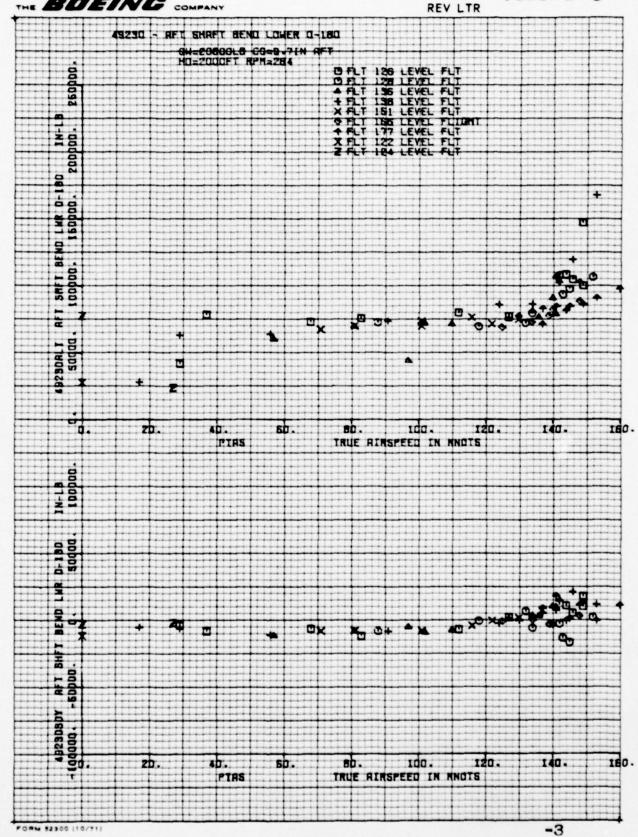
D M-D S.S. 2000FT 20. 40. 60. 8b. 100. 120. TRUE RIRSPEED IN MNOTS 10.: 11.: PTRS вр. 100: 140. 180. TRUE AIRSPEED IN MNOTS

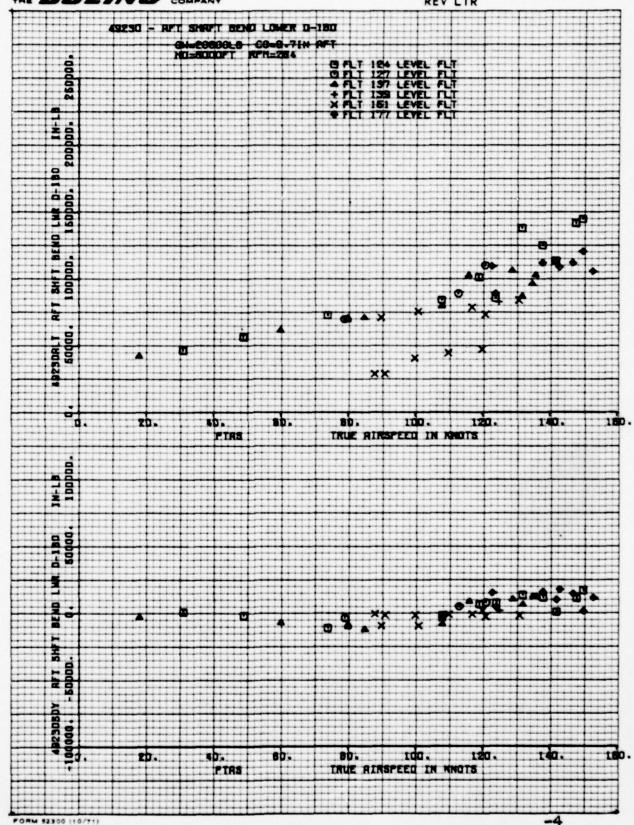
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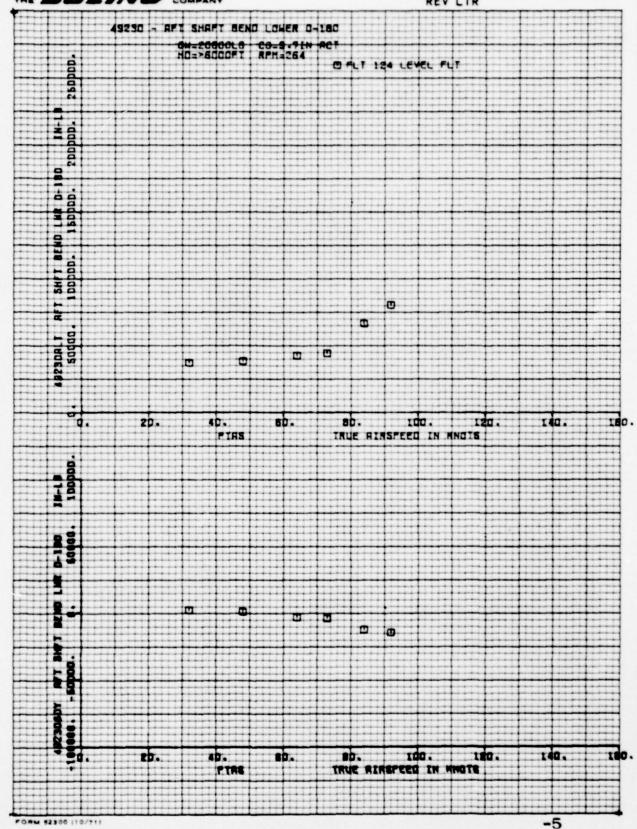
FORM \$2300 (10/71)



NUMBER

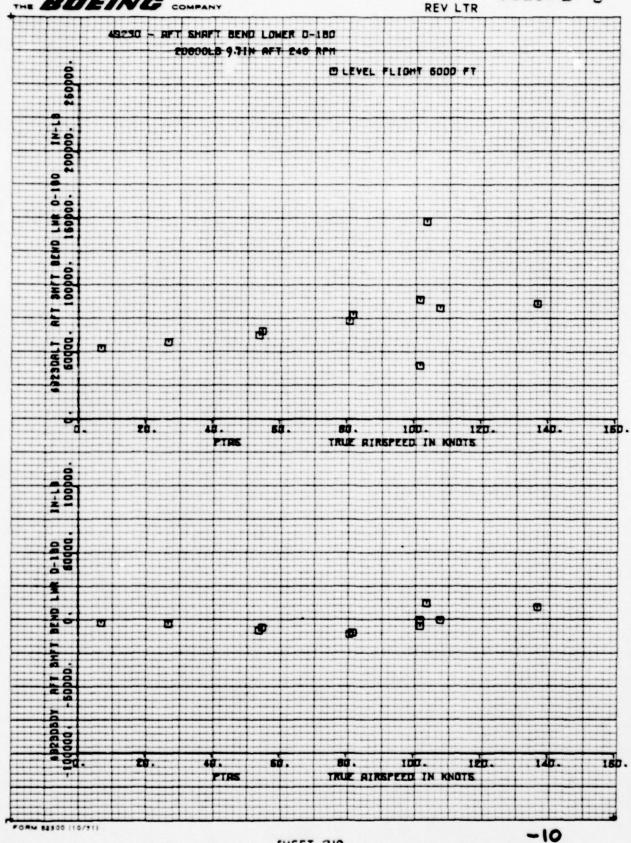


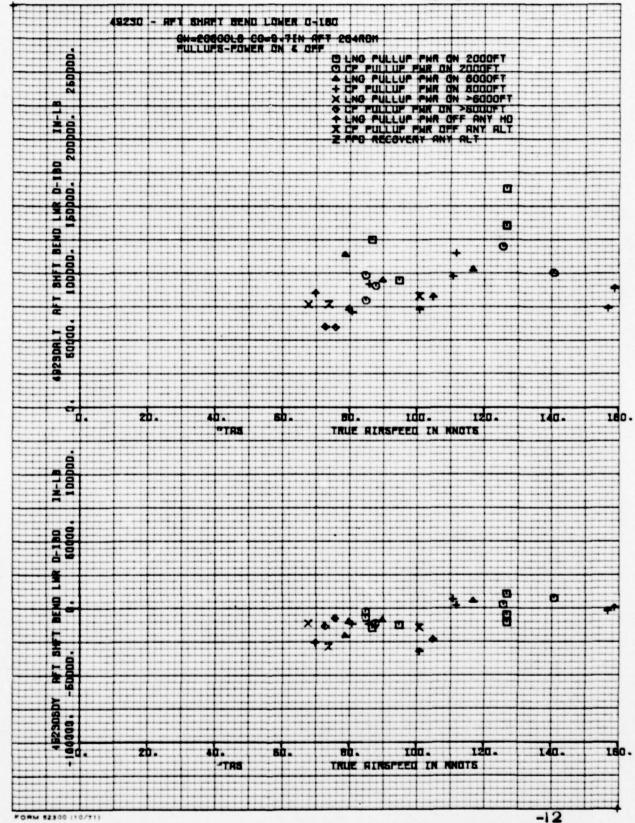


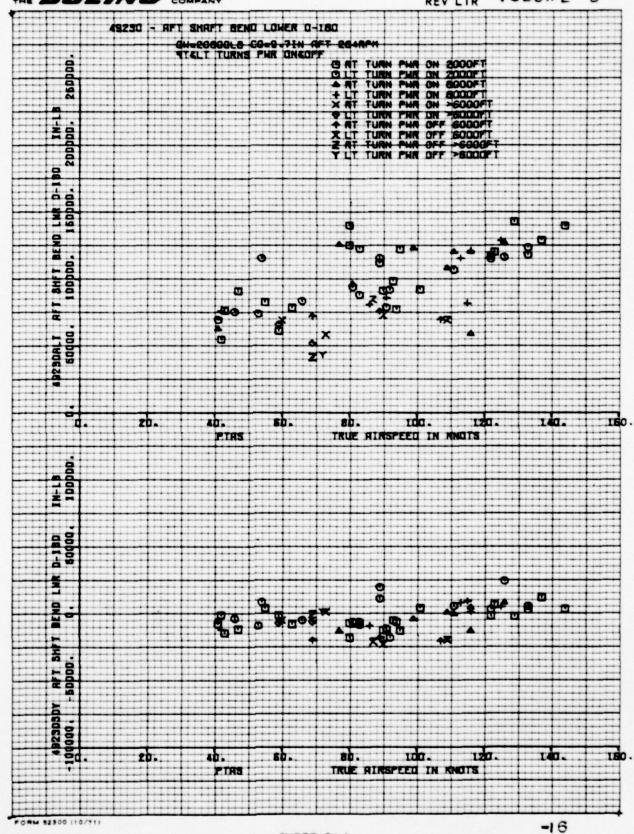


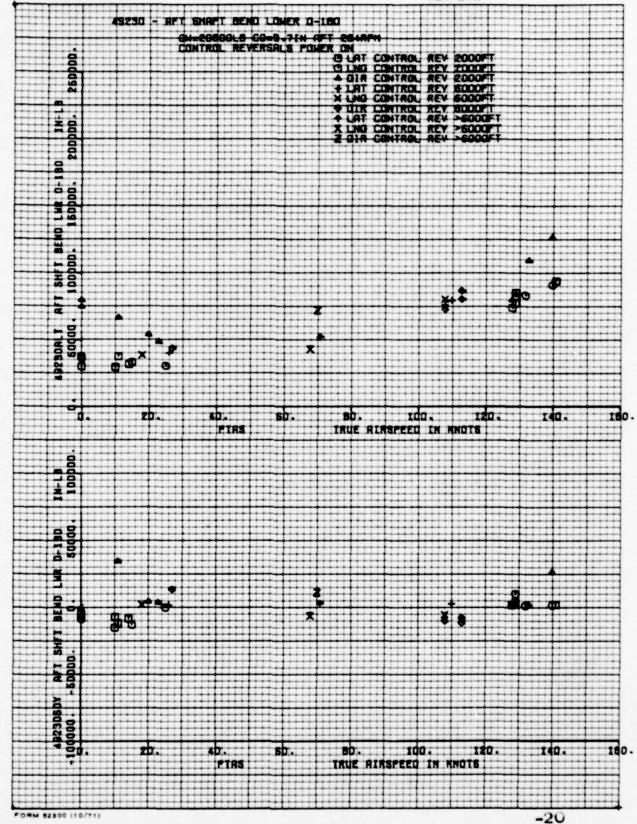
NUMBER

HE BOEING COMPANY



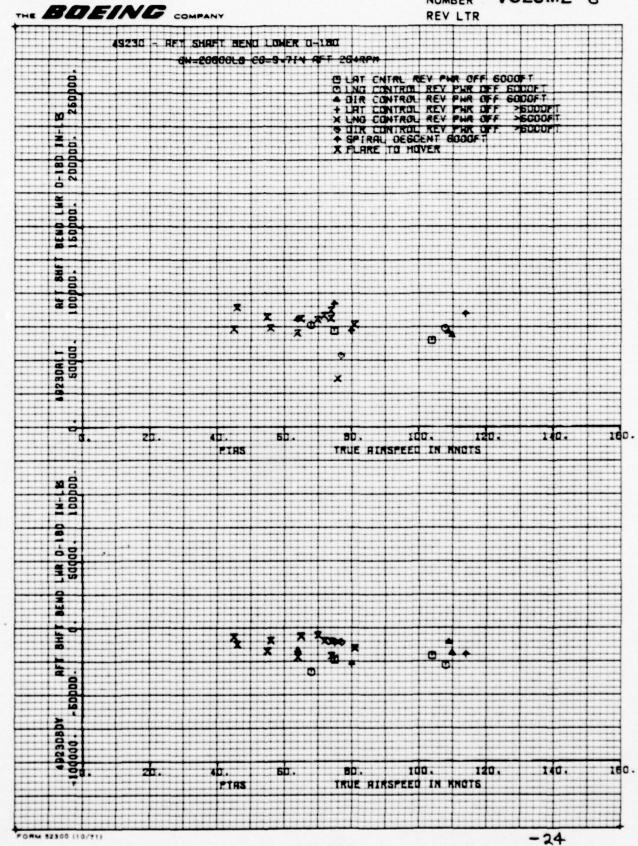






NUMBER VOLUME 8

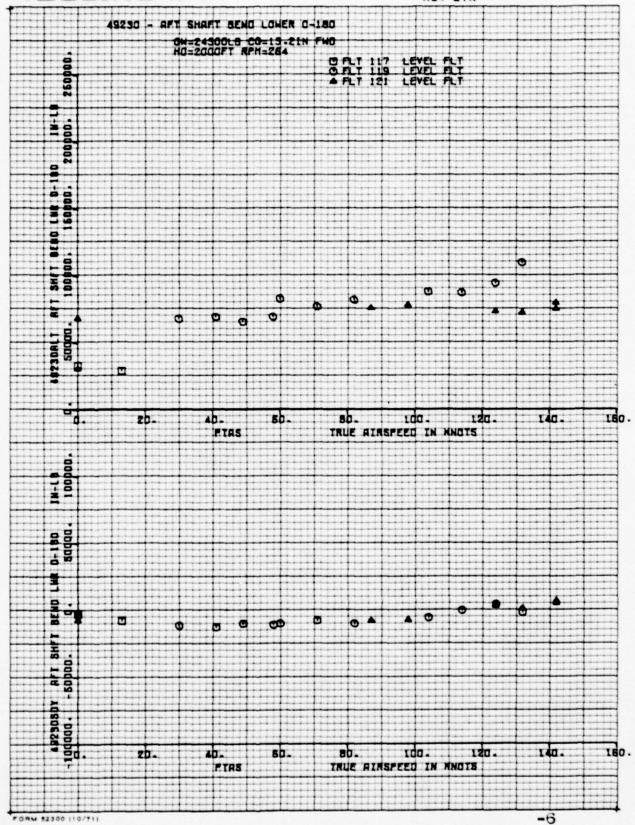
REV LTR

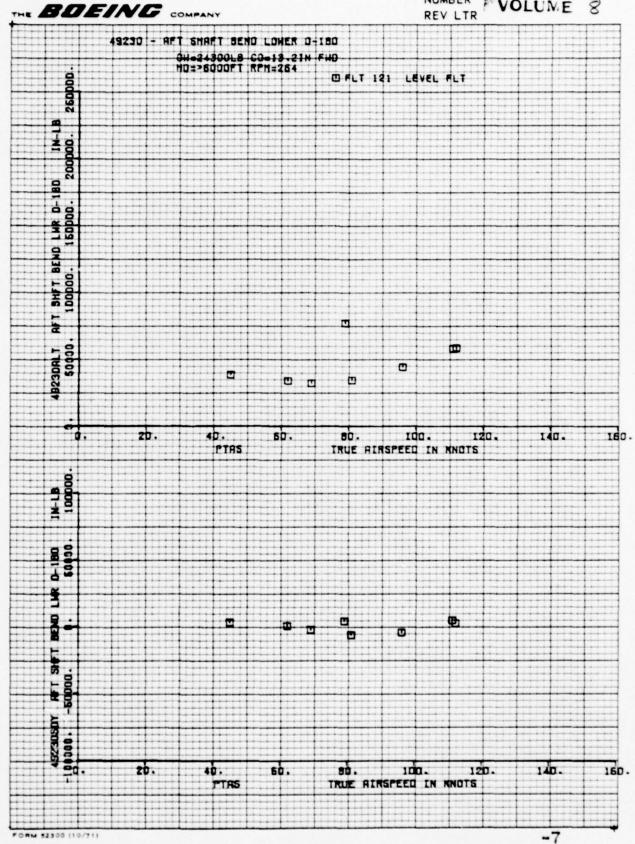


D210-11168-3 NUMBER VOLUME 8 THE BOEING COMPANY REV LTR 49290 - AFT SHAFT BEND LOWER 0-180 04-20800LB CO-9 71H AFT 284RPH M A/R STEADY SCOOPT O A/R STEADY >6000PT A PPD SCOOPT + PPD >6000FT 260000 80 IN-LB 200000 40. 140. 160. TRUE AIRSPEED IN KNOTS 100. 140 . 180. 40. TRUE AIRSPEED IN MNOTE TAS

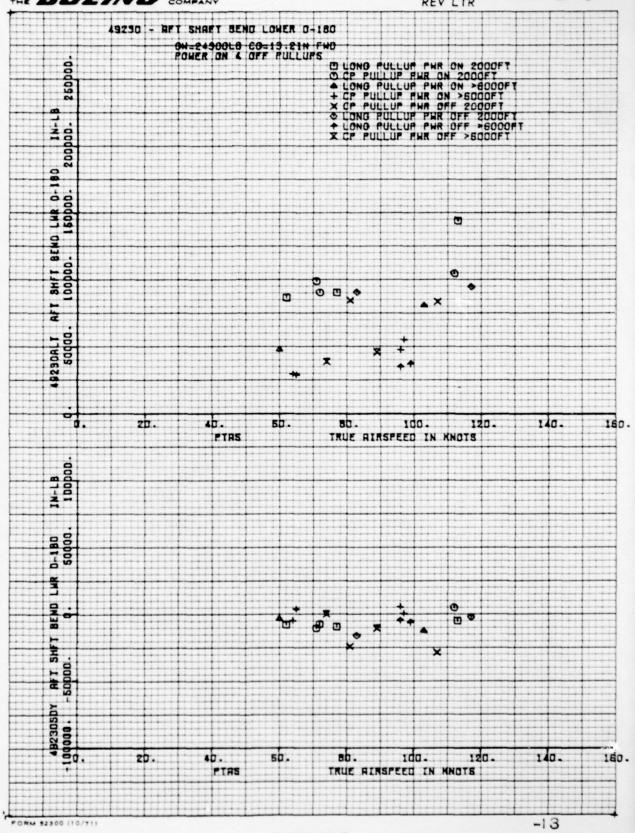
FORM \$2300 (10/71)

-28

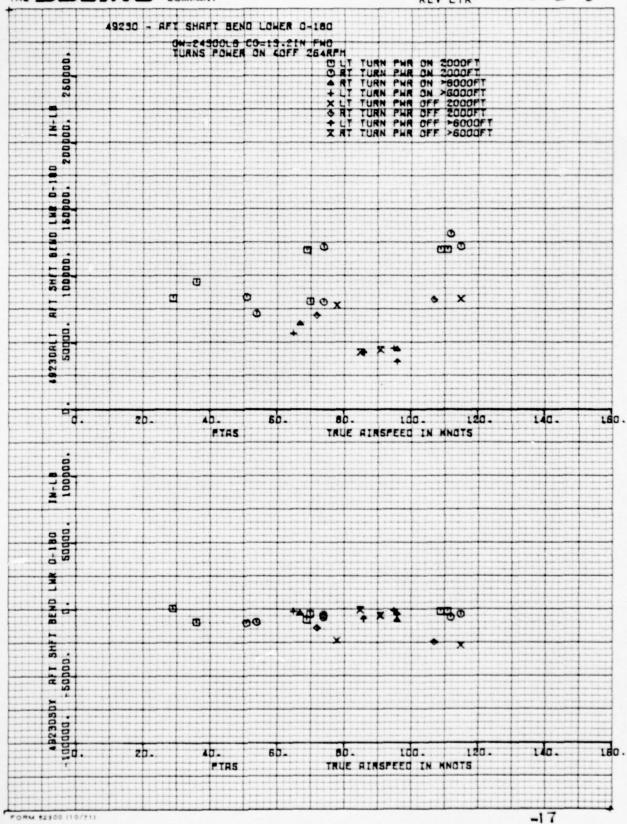




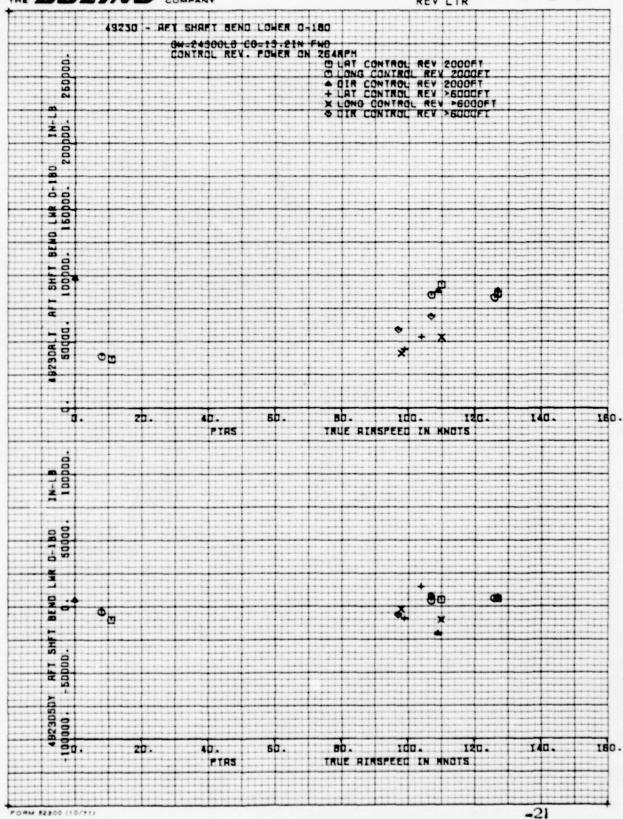
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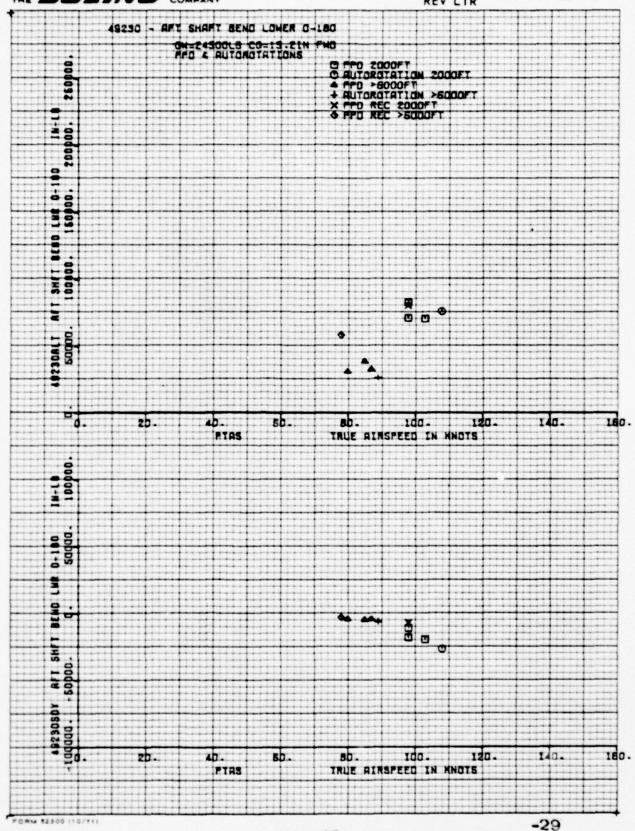


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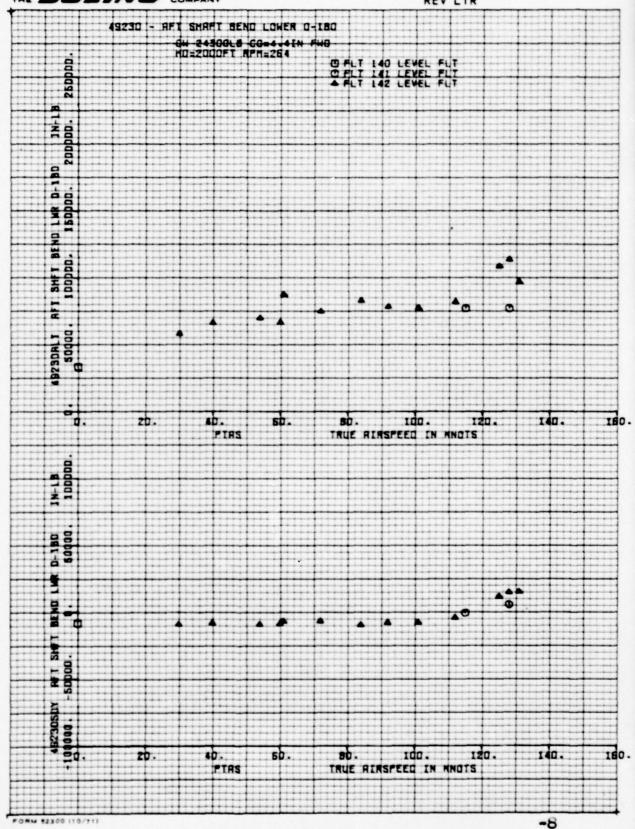






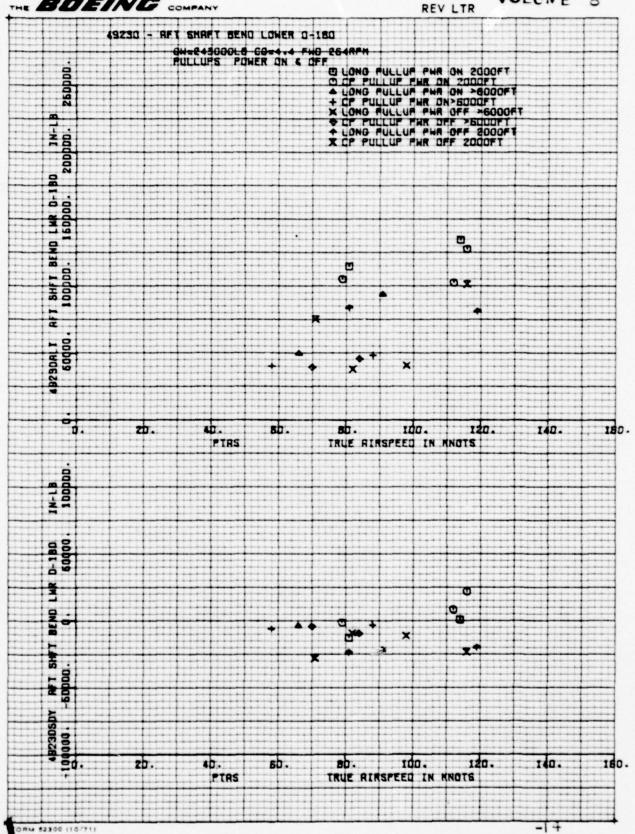
D210-11168-3 NUMBER VOLUME 8

THE BOEING COMPANY

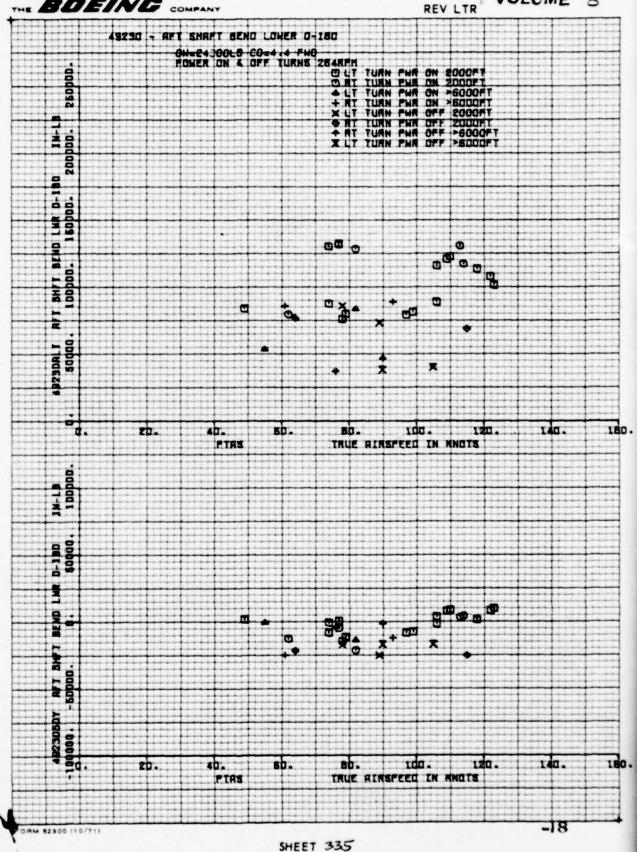


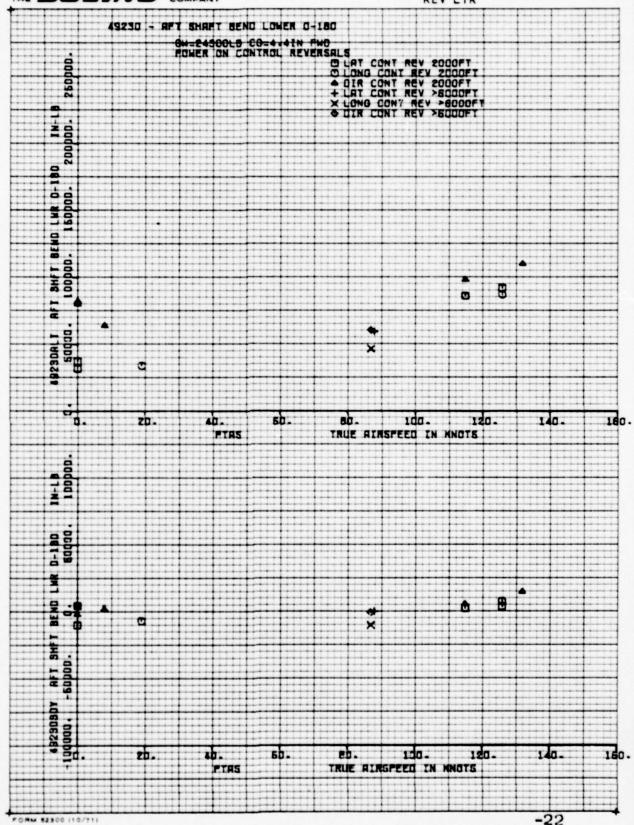
FORM \$2300 (10/71)

THE BOEING COMPANY REV LTR 49290 - AFT SHAFT BEND LOWER 0-180 GH-8480GLB CO-4 AIN FHD HD=>6000FT 284RFH B FLT 141 LEVEL FLT 0 0 . U D. 20. 50. ... 80. 100. 120. AU. PIAS TRUE RIRSPEED IN KNOTS 140. 40. 60. TRUE RIRSPEED IN MOTE TAS

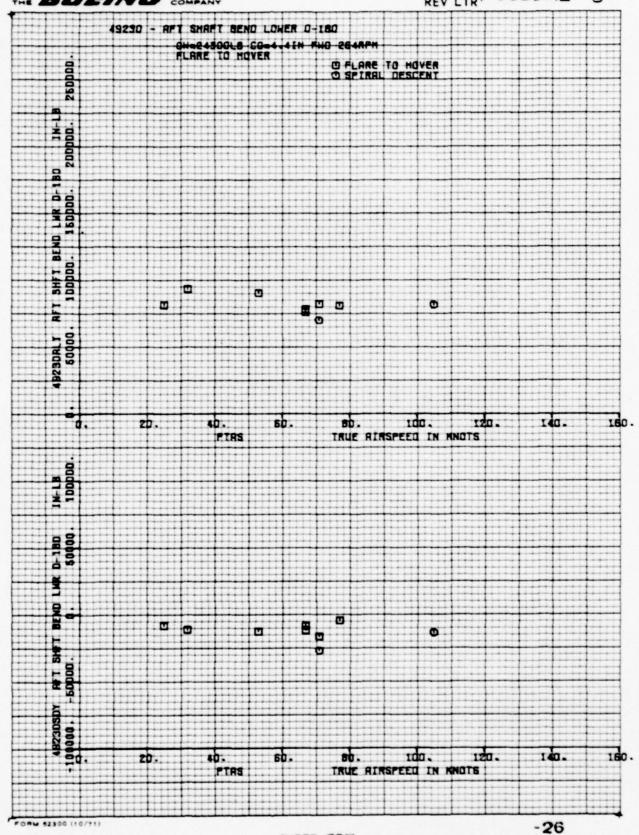




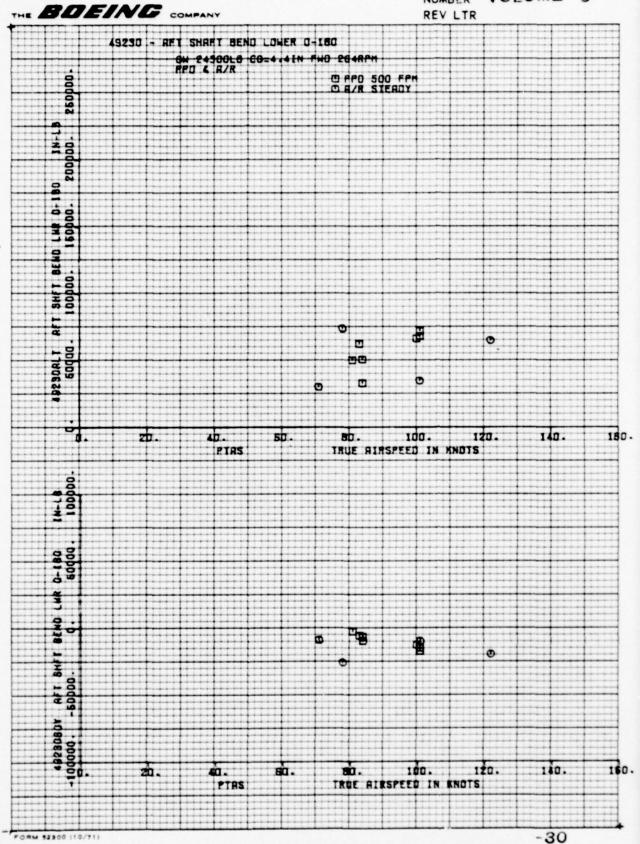


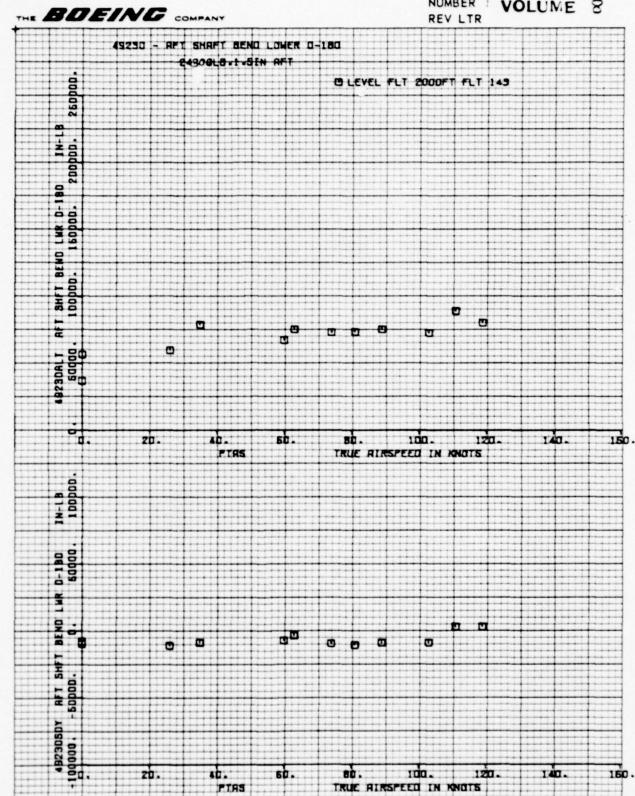






NUMBER VOLUME 8





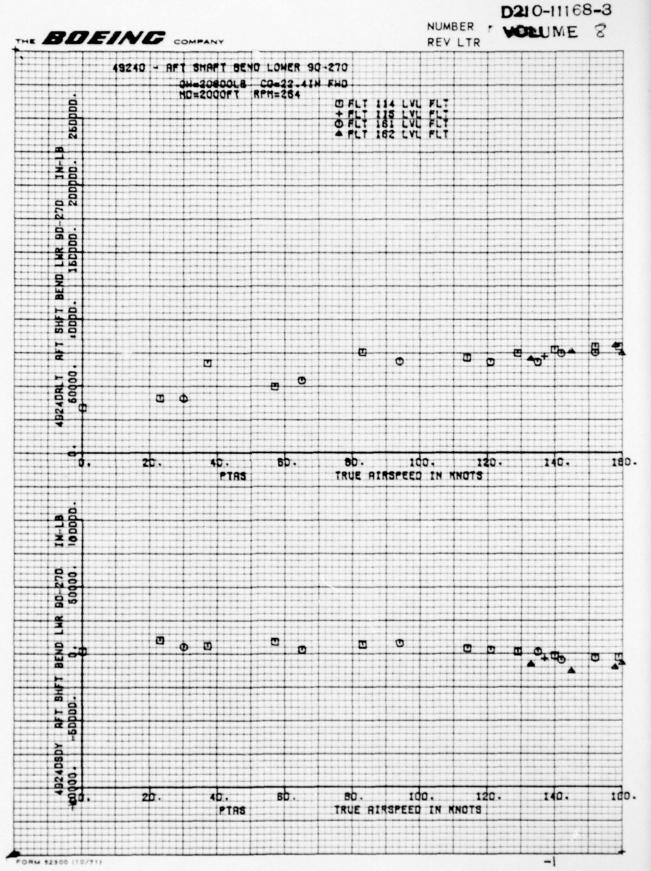
PREPARED BY: J. Bendo

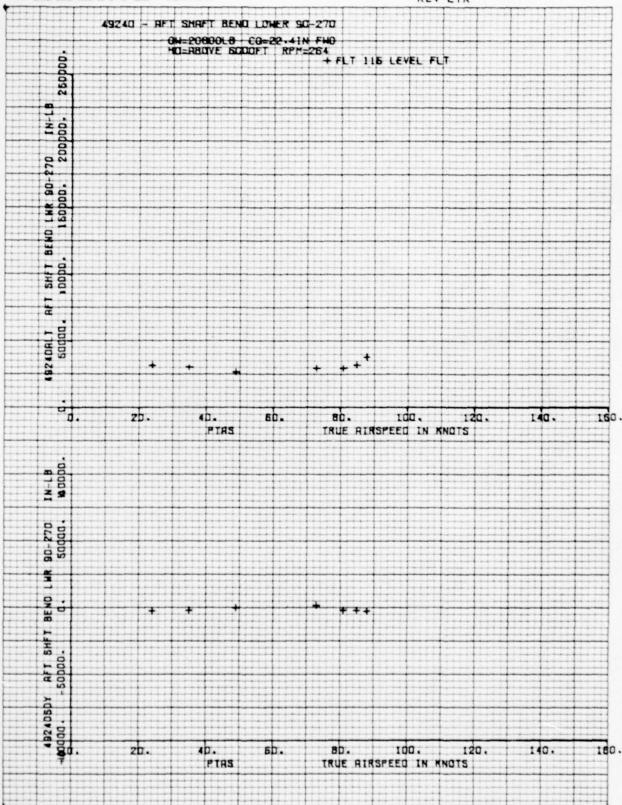
THE BOEING COMPANY DATE: 8/28/78

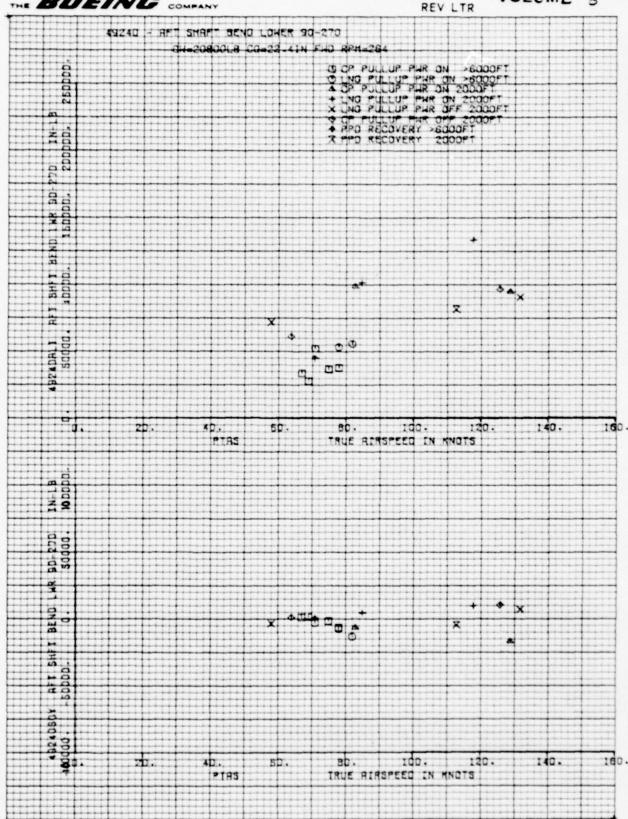
NUMBER D210-11168-3 REVLTR Volume 8

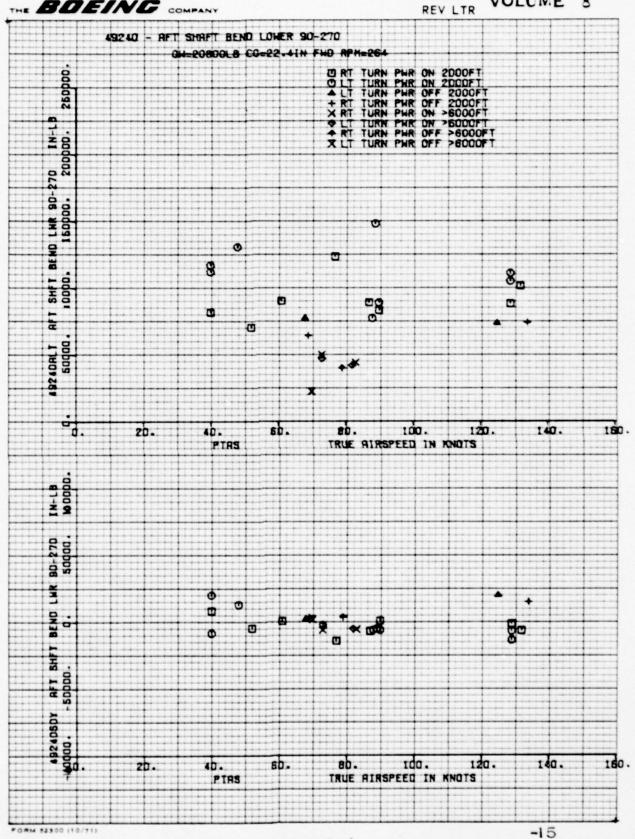
MODEL NO.

4.10 Aft Shaft Bending, Lower (90° - 270°)

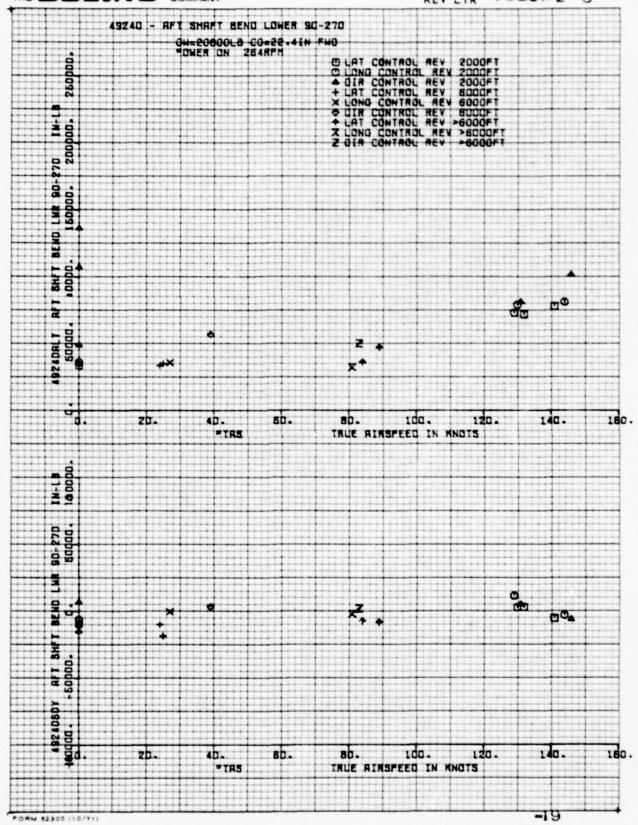




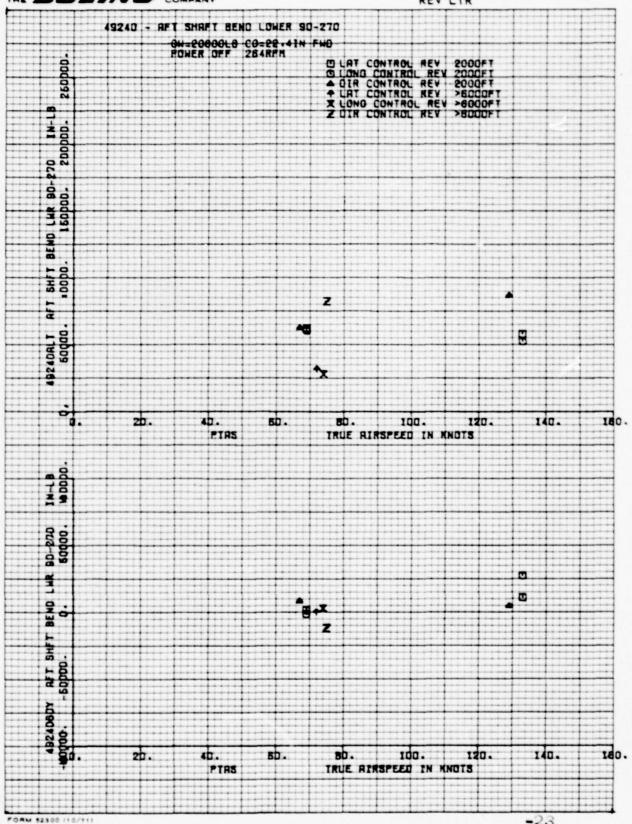




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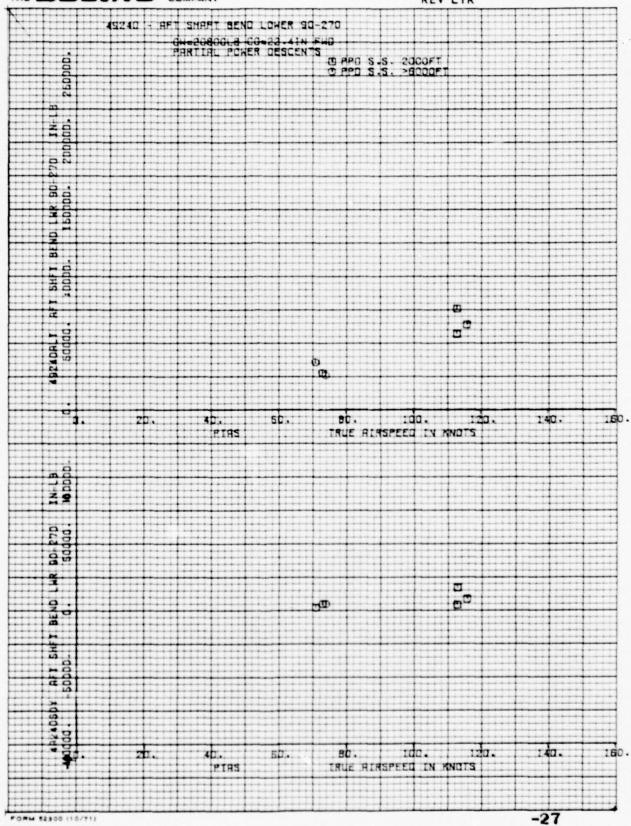


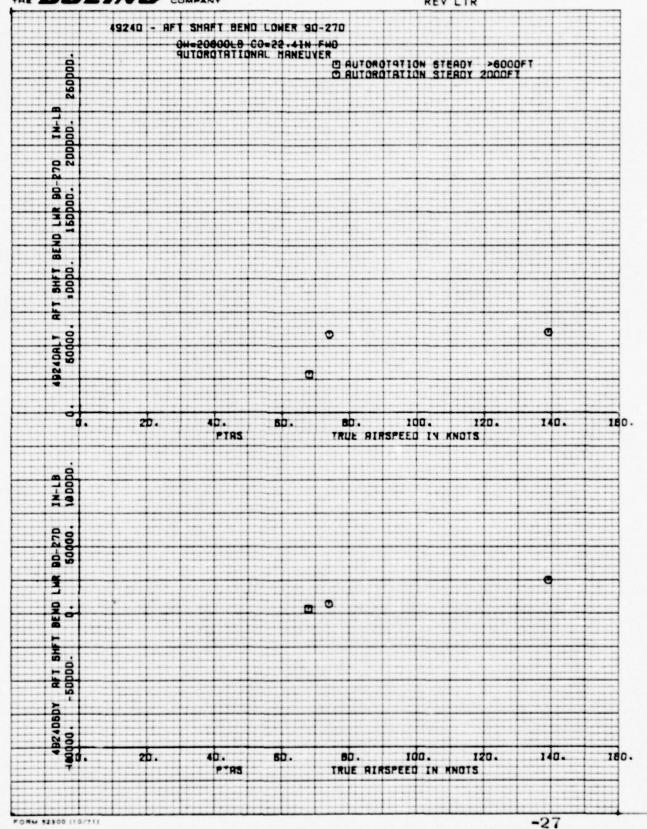
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NUMBER REV LTR

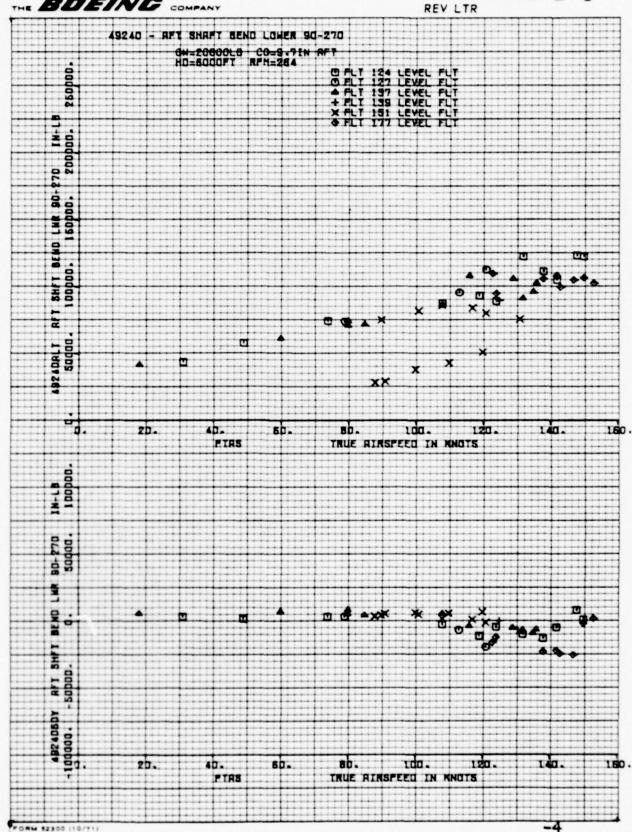
THE BOEING COMPANY 49240 - RFT SHRFT BEND LOHER 90-270 GH=20000LB CO=22.4IN FHD 204RPH E FLARE PHR ON 99 0 0 86. 100. 120. TRUE RIRSPEED IN KNOTS PIRS 4 0 8b. 1 1da. 1 150. 40. TRUE RIRSPEED IN MNOTS TRS



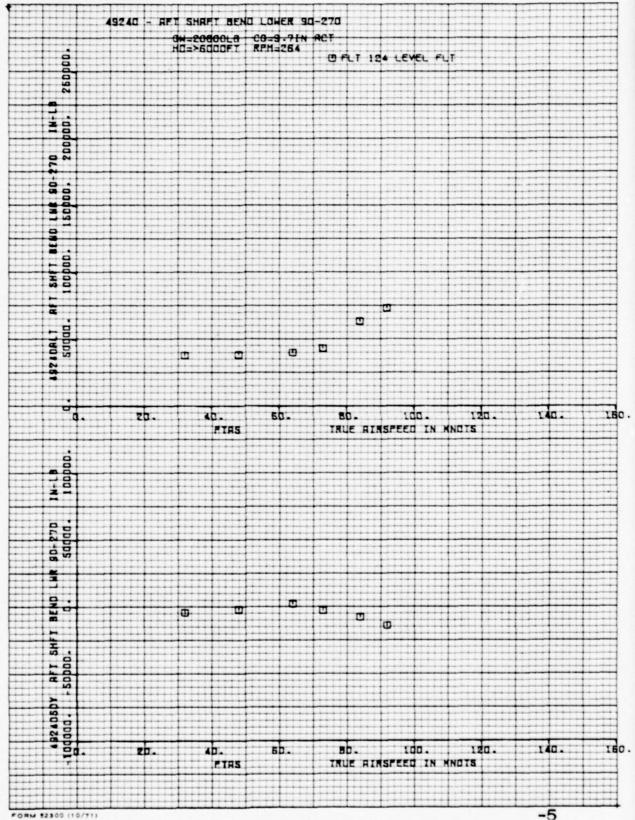


VOLUME 8 NUMBER

THE BOEING COMPANY



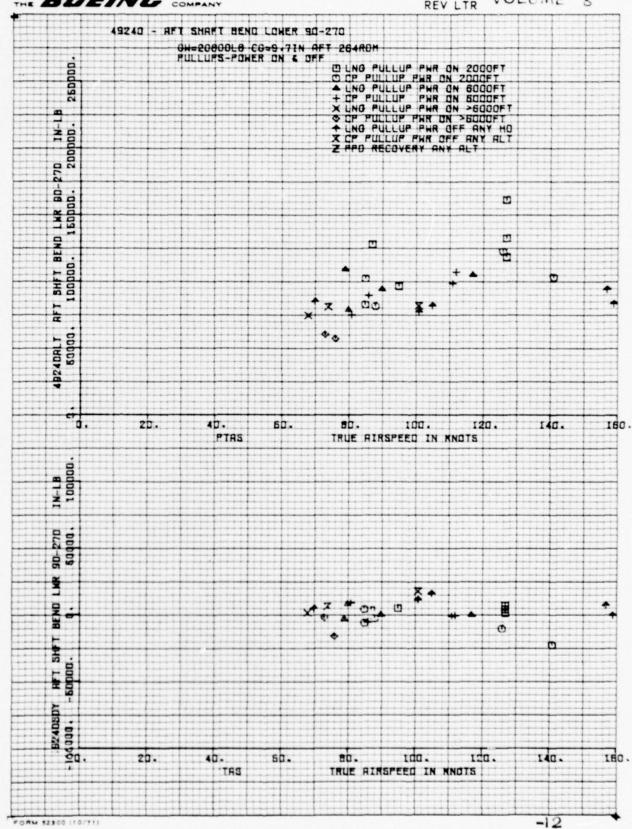
NUMBER VOLUME 8 REV LTR



NUMBER REV LTR

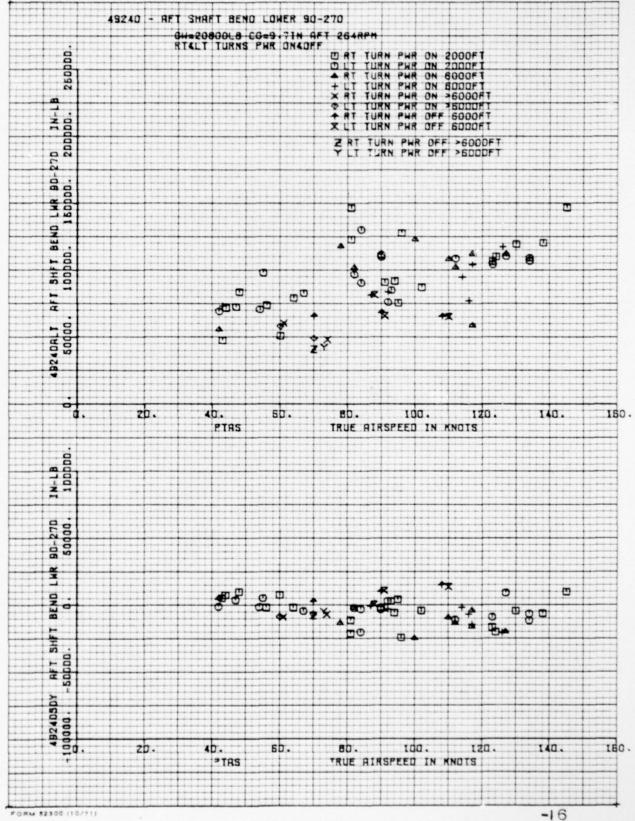
THE BOEING COMPANY 49240 - AFT SHRFT BEND LOHER SD-270 20800LB 9.71N AFT 248 RPH DLEVEL FLIGHT 6000 FT 60240ALT AFT SHFT BENG LMR 90-270 IN-LE 0 0 0 0 8 D 100. 120. 80. 140. IED. TRUE RIRSPEED IN KNOTS PTAS 0 120. 140. 160. ıda. 50. 40. TRUE RINSPEED IN MNOTS PTRE TORM \$2300 (10/71) -10

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NUMBER | VOLUME 8

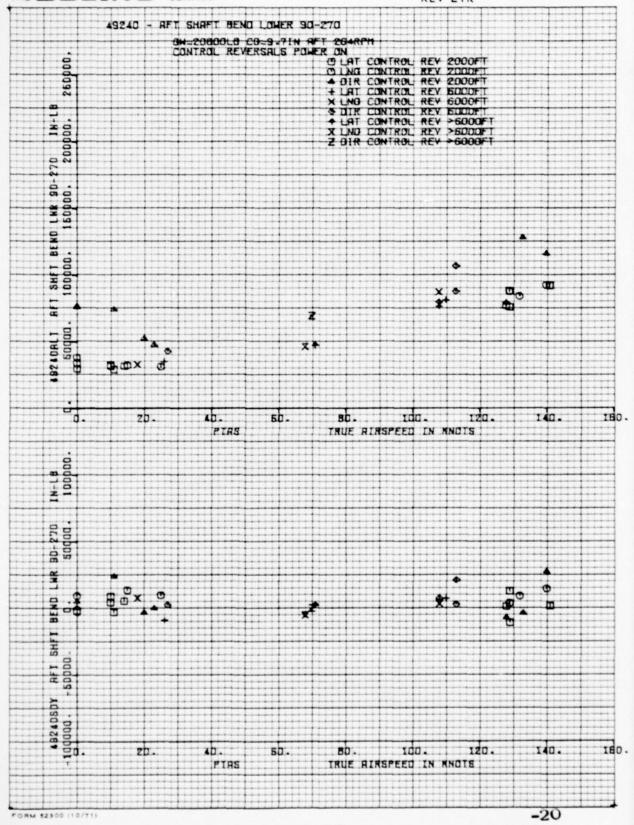
THE BOEING COMPANY REV LTR 49240 - AFT SHAFT BEND LOWER 90-270

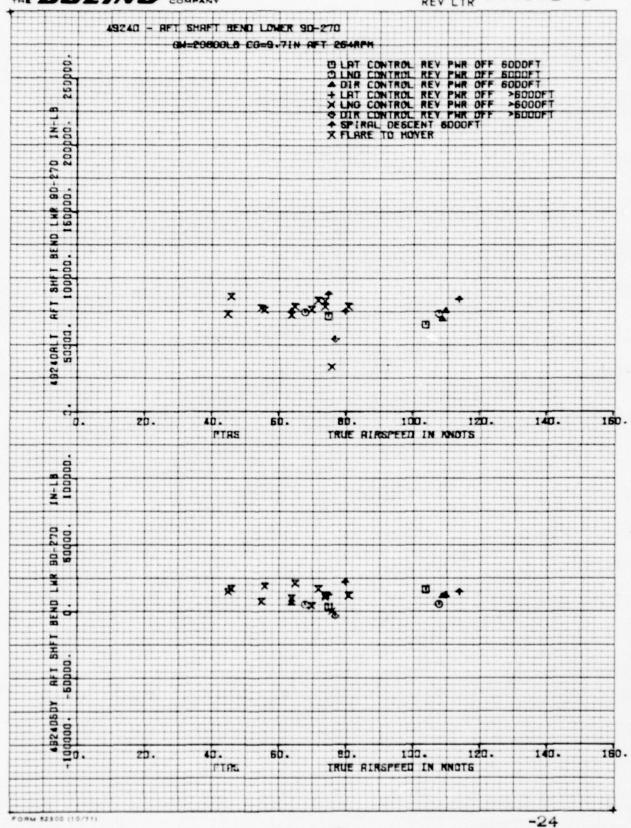


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THE BOEING COMPANY

NUMBER! VOLUME 8 REV LTR





140.

-28

160.

THE BOEING COMPANY REV LTR 49240 - RFT SHRFT BEND LOWER 90-270 GH-20800LB CO-8-7IN AFT 284RPM U A/R STERRY 6000FT
O A/R STERRY >6000FT
A PPD 6000FT
+ PPD >6000FT ZEDDDD. 48240RLT RFT SHFT BEND LWR BD-27D IN-LB 50404. 100000. 160000. 200000. ıdq. 140. 160. 20. 50 . 80. 120. 40. TRUE RINSPEED IN MNOTS PTAS 50000

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TAS

100.

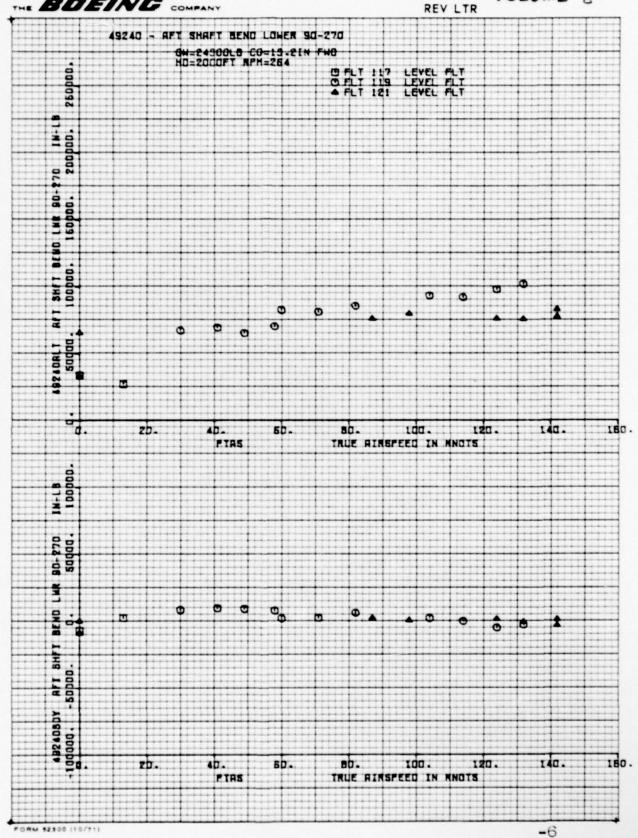
TRUE AIRSPEED IN MNOTS

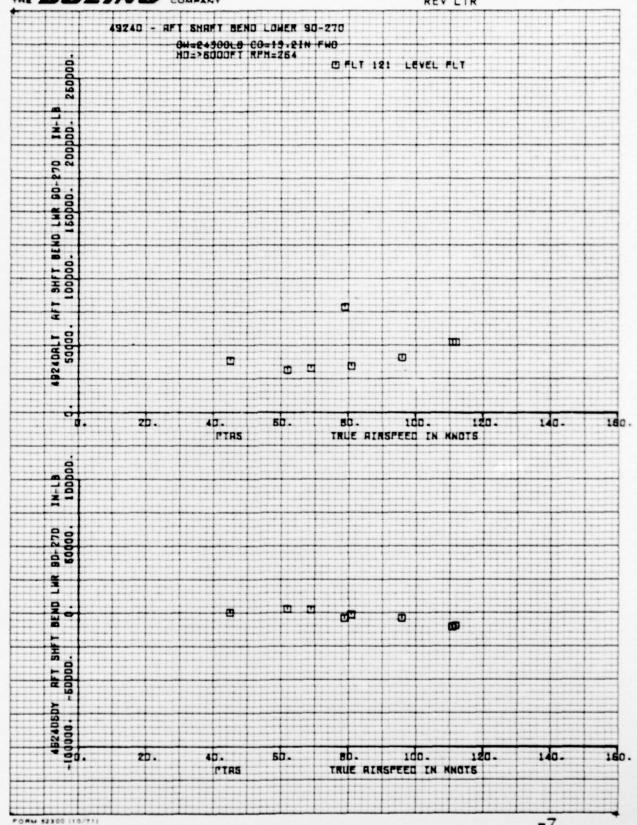
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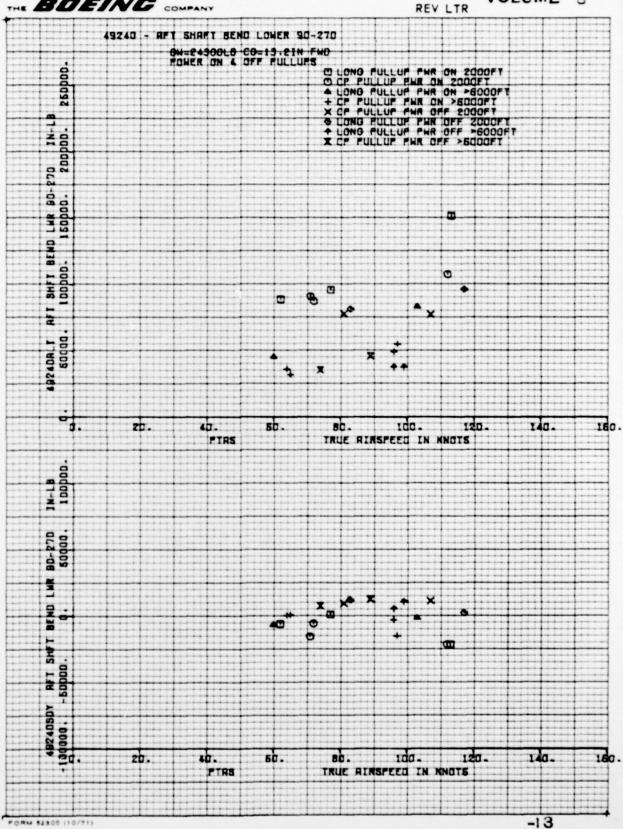
FORM \$2300 (10/71)

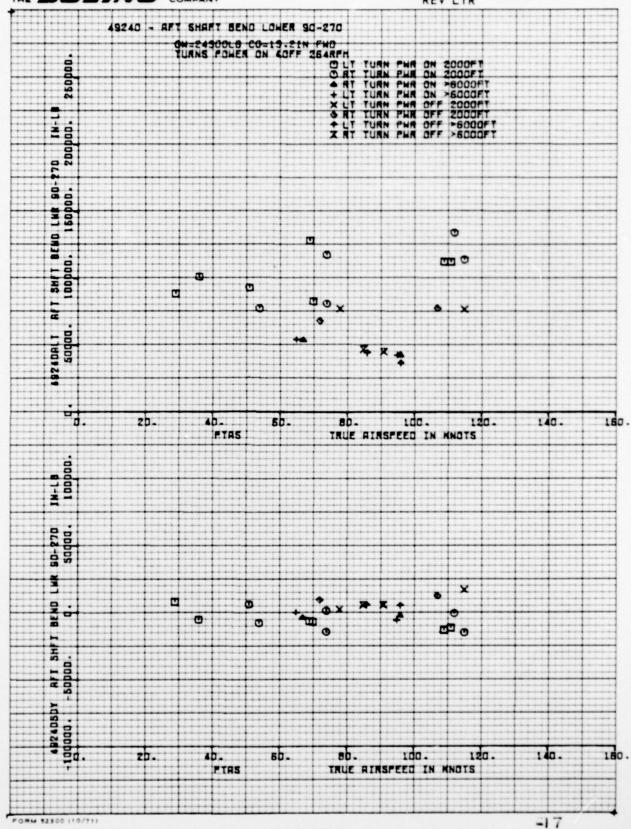
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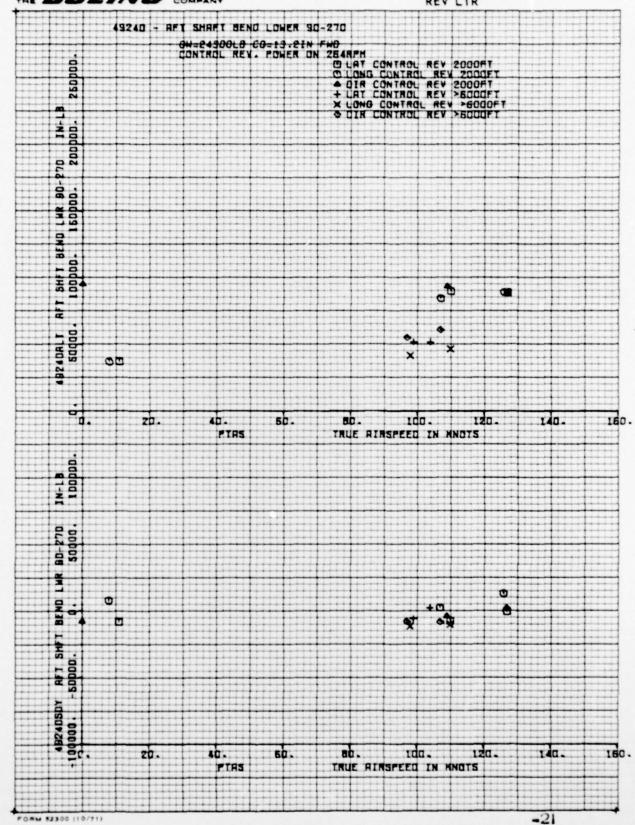


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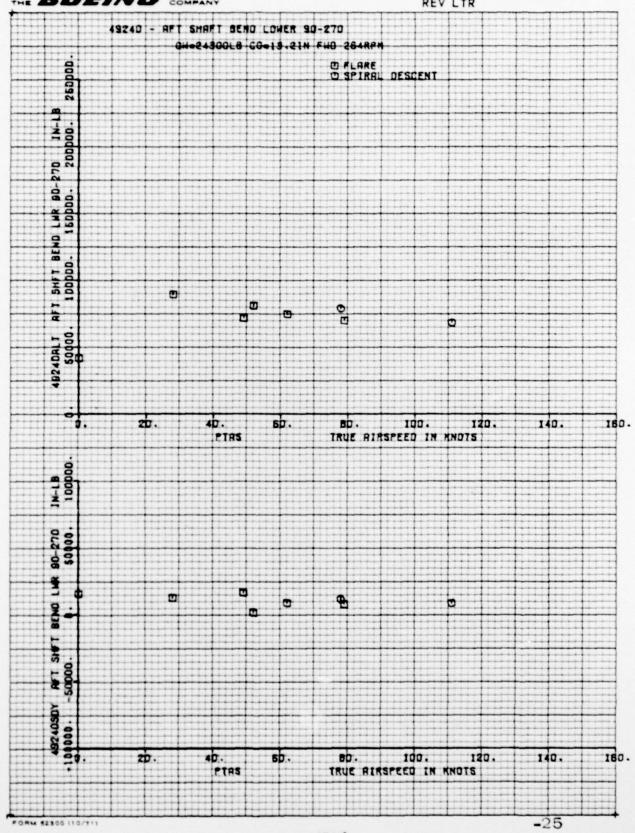


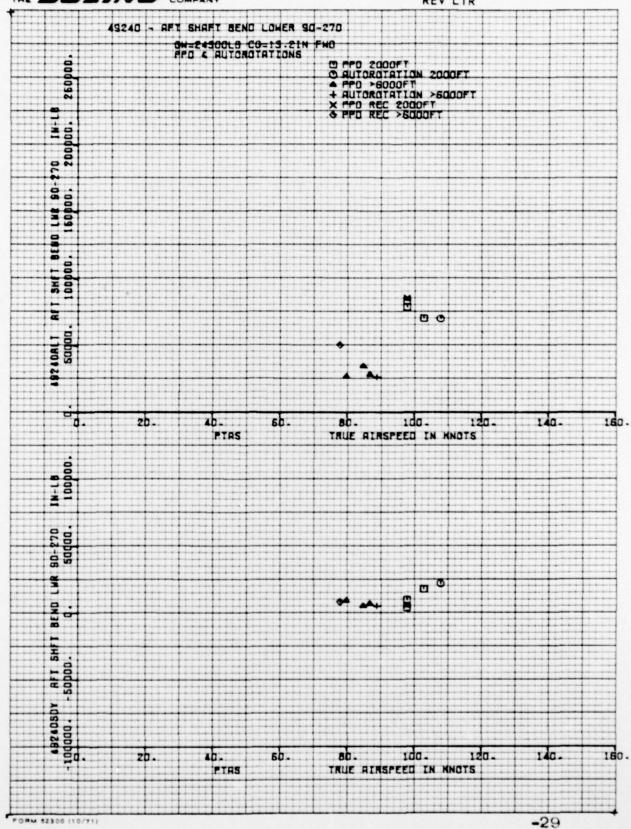


NUMBER! VOLUME 8



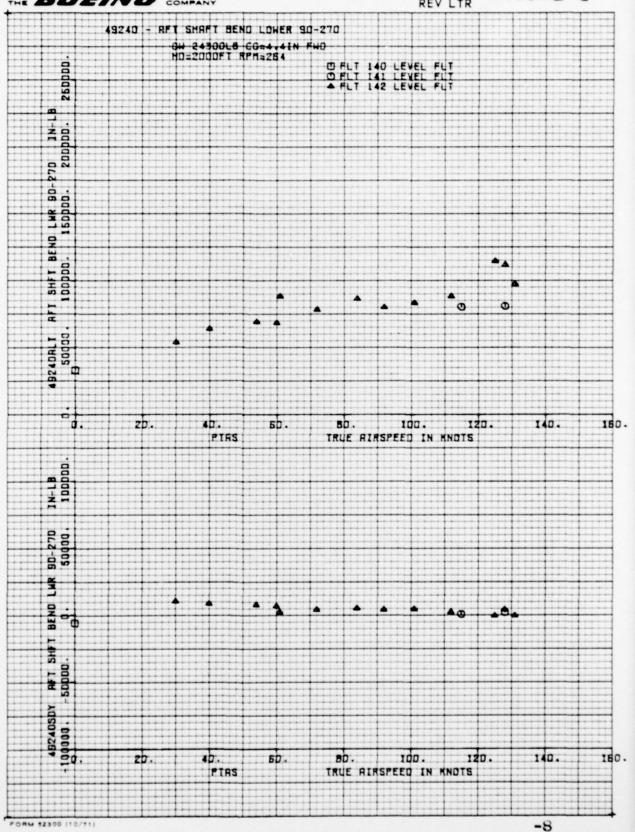


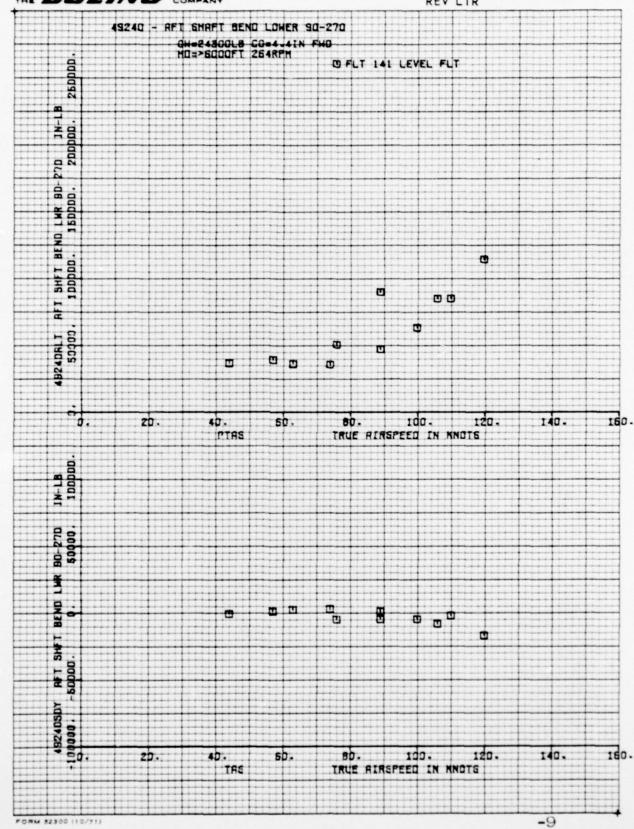




THE BOEING COMPANY

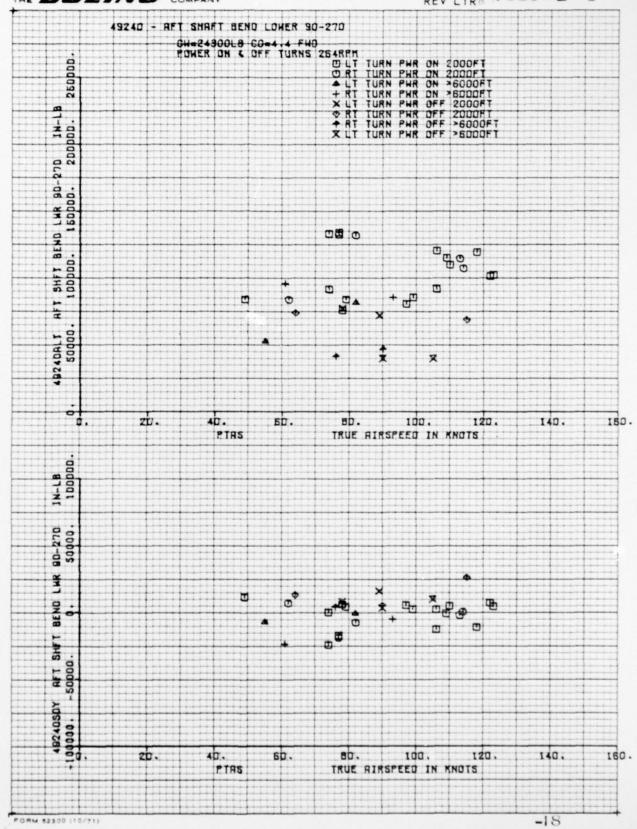
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NUMBER VOLUME 8 REV LTR

THE BOEING COMPANY 49240 - RET SHRET BEND LOWER 90-270 SH-245000LB CO-4.4 FHO 264RPM BULLUPS POWER ON & OFF D LONG PULLUP PHR ON 2000FT
O CP PULLUP PHR ON 2000FT
LONG PULLUP PHR ON >6000FT
LONG PULLUP PHR ON >6000FT
CP PULLUP PHR OFF >6000FT
CP PULLUP PHR OFF >6000FT
LONG PULLUP PHR OFF 2000FT
CP PULLUP PHR OFF 2000FT
CP PULLUP PHR OFF Z000FT 260000. 150000. 200000. 100000. 0 0 B - T X 49240ALT 60000 ZD. 40. 50. 100. 120. 140. 180-80. PIRS TRUE RIRSPEED IN KNOTS 100000 50000 X BEND × **E** 9 Y AFT SHFT -SODOD. 0 48240SDY 140. 120. 160. 40. 80. 100. zb. TRUE AIRSPEED IN KNOTS PTRS - TORM \$2300 (10/71) -14

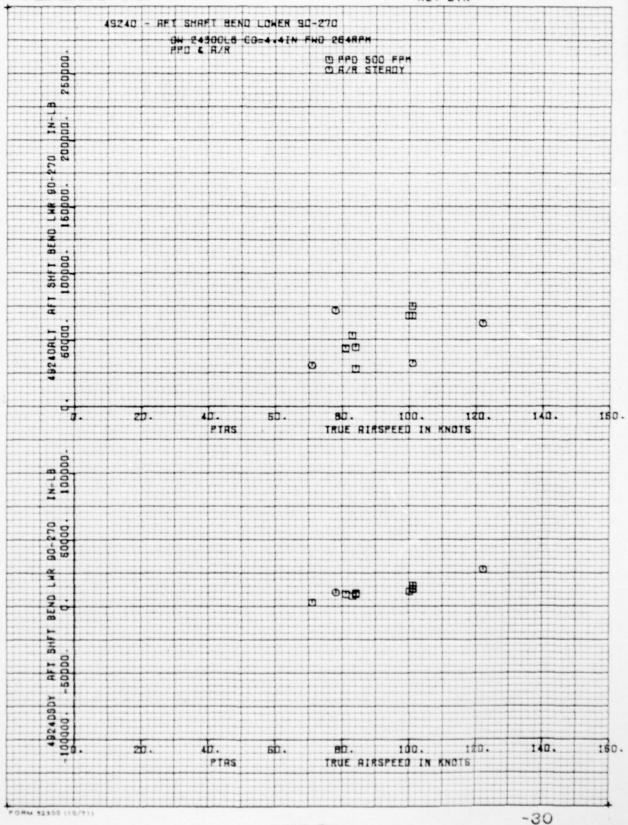


-22

NUMBER

REV LTR 49240 - RET SMRET BEND LOWER 90-270 GH-24300LB CO-4-4IN FHO POHER ON CONTROL REVERSALS SALS
BLAT CONT REV 2000FT
CLONG CONT REV 2000FT
A DIR CONT REV 2000FT
+ LAT CONT REV >6000FT
X LONG CONT REV >6000FT
DIR CONT REV >6000FT 250000 I BHFT BEND LWR 90-270 IN-L 0 t RFT 4 4824DRLT 50000. × 四 9. 50. 140. 100. IZO. zp. AD. 80. PIRS TRUE REASPEED IN KNOTS IN-LB 80-27D 60000. - XX 0 0 0 - 60000. 482408DY 50. ep. 100. 120. 140. 40. TRUE RIRSPEED IN MNOTS FTRS

NUMBER VOLUME 8



NUMBER REV LTR VOLUME 8



